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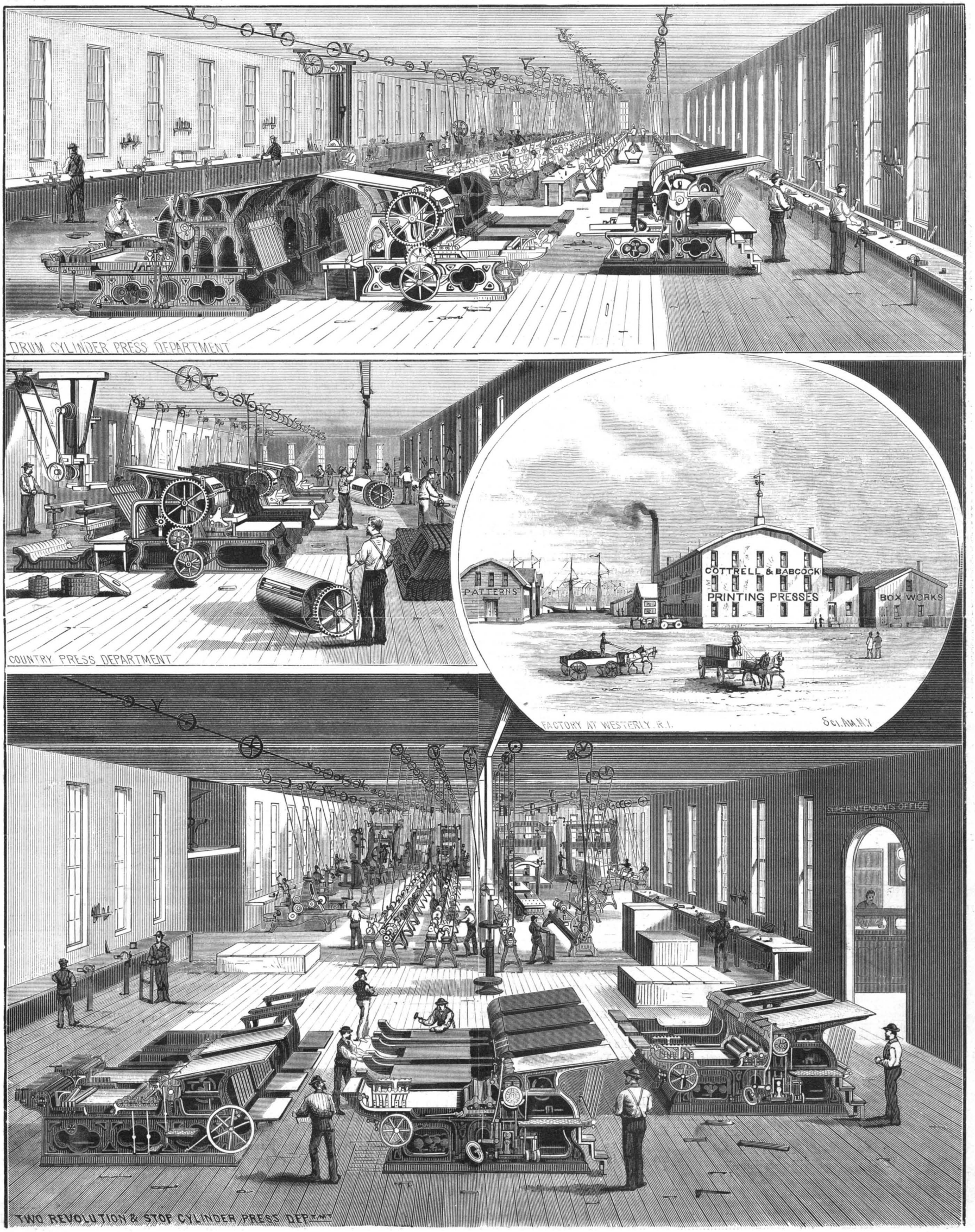

THE MANUFACTURE OF POWER PRINTING PRESSES.—WORKS OF MESSRS. COTTRELL & BABCOCK, WESTERLY, R. I.—[See page 196.]

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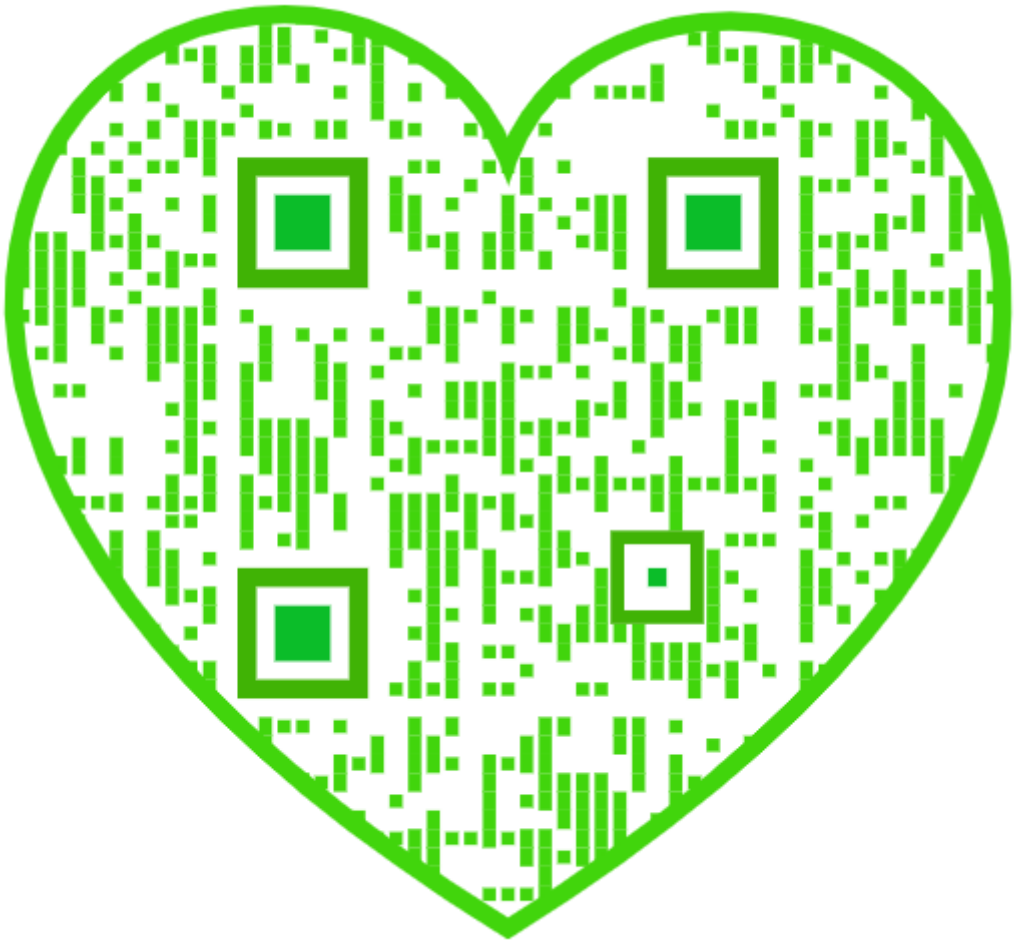

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NEW YORK, SATURDAY, MARCH 27, 1880.

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SHIP RAILWAYS FOR ISTHMUS CROSSINGS.

The superior advantages of a ship railway for the Isthmus of Darien were considered at some length in the SCIENTIFIC AMERICAN for August 2, 1879, in connection with a forcible paper on the same subject by Captain Eads. Attention was then called to the fact that this distinctively American plan of solving the isthmian difficulty had commended itself to American engineers long before the success of the Suez Canal gave a speculative impetus to canal projects for uniting the great oceans by way of Central America.

And now that M. de Lesseps is urging so vehemently his scheme for a sea-level canal at Chagres, the ship railway project has again risen to prominence. This not solely because of the theoretical favor it commands from capable engineers, but also because of the practical commercial interest called out by the bill before Congress, looking to the actual construction of a ship railway across the Isthmus, and its ultimate control by the United States.

In the current issue of the SCIENTIFIC AMERICAN SUPPLEMENT will be found an extended reply by Captain Eads to the argument of M. de Lesseps, before the House Canal Committee, in favor of the Chagres canal, and a clear statement of the advantages of a ship railway instead. Captain Eads maintained that a substantial and durable ship railway could be built at half the cost of a canal with locks, and a quarter of the cost of a tide-level canal, with a saving of from two-thirds to three-fourths the time required for constructing a canal. The railway would have the further advantage of capacity to move ships of maximum tonnage four or five times faster than would be possible in a canal, thus allowing many more ships to pass each way in a given time; while the cost of maintenance and operation would be less than with a canal. With this superior capacity for meeting the varying demands of commerce, both as to the size and the number of the vessels transferred from ocean to ocean, a ship railway can be built and operated where a canal would not be possible; and, being above ground, it is possible to estimate with great accuracy what it would cost and how long it would take to build it. A canal, on the contrary, is strictly a hydraulic construction, involving the control of water and the execution of works under water, with liability to irruptions of water, making an accurate estimate of the time and cost of construction an impossibility.

Captain Eads illustrated his plan to the House Committee by means of drawings. The proposed railway led into the water to the depth of 30 feet, along an incline having a grade of 1 in 100; a cradle being thereby submerged for the reception of the ship to be transported across the Isthmus. The railway consisted of 12 steel rails, weighing 70 lb. to the yard; the wheels under the ship's cradle being 3 feet apart and bearing a maximum pressure of 5 tons, with capacity to withstand a pressure of 20 tons. The number of rails and the great weight of the ship, he insisted, would make derailment impossible; and the great number of wheels under the cradle would so equalize the oscillation that there would be no perceptible motion in the ship's cabin. Touching ability of ships to withstand the strain of land transportation, Captain Eads said that any vessel thought capable of withstanding the gales and hurricanes of the Atlantic and Pacific oceans, was capable of being carried on this railway with absolute safety—indeed, with as much safety as a child in its mother's arms. His plan had been received with favor by Mr. E. J. Reed, the Chief Constructor of the British Navy; Mr. John Roach, Mr. Henry Steers, and a great number of the most eminent engineers of America.

As in the case of his successful improvement of the mouth of the Mississippi River, Captain Eads proposes to assume all the risk. Having demonstrated the practicability of a ship railway for the Isthmus, by transporting thereon a vessel of maximum tonnage from ocean to ocean, he asks, in the bill referred to, that the United States shall guarantee the payment of an annual interest of six per cent on the cost of construction, and acquire thereby the right to regulate the tariff of tolls.

The well earned reputation of Captain Eads as a practical and thoroughly scientific engineer, and the support he commands from engineers of high rank, furnish the highest assurance that the plan he proposes is feasible; and its manifest economy should have great weight in determining what kind of trans-isthmian route shall be adopted. If, at the cost of one canal, three or four railways of equal capacity can be built along as many different lines, it will be a queer commentary on American thrift and business capacity if M. de Lesseps persuades American capital to invest in his canal.

EVILS OF NEGLECTING COLD IN THE HEAD.

In a paper read by Dr. D. B. St. John Roosa of this city, at the recent meeting of the Medical Society of the State of New York, he stated that the most frequent origin of chronic diseases of the lachrymal passages, of the conjunctiva, and of the middle ear, is in a neglected "cold in the head." It is generally conceded that no person in perfect health, except under extraordinary circumstance, takes cold, and yet the majority of mankind have, at some time, suffered from cold in the head. The popular idea that a cold in the head is an insignificant affair is founded on the fact that most of the people recover to such an extent that they are able to go about afterward and engage in their ordinary avocations without special notice, at the time, of the consequences of the disease, which may even then be settled upon them. He believed that very many of the maladies which prevented men and women from reaching the allotted period of three score and ten have their origin in these colds; and that many serious affections which act as an impediment to the success of their victim are dated from a cold in the head.

He described the suffering incident to an acute attack of cold in the head, and of the impossibility of having repeated attacks without producing serious local changes—not only local change, but a permanent impairment of nutrition. To correct all this, special attention must be paid to *individual* hygiene, and if the evil consequences of neglected cold in the head were to be abolished, the abolition must come through a public sentiment properly educated upon this as upon all other sanitary questions. The family physician must warn the people everywhere, as opportunity offers, of the danger in this direction, and of the means by which it is to be avoided. The first great precaution to be taken by each individual is to keep himself in a good general condition, and to do that he must studiously avoid all that tends to disorder the skin and the functions of all the organs of the body. Children must be clothed in flannel all the year round, and must be made to know that the staples of diet are milk, bread, meat, vegetables, and fruit, and that tea, coffee, and pastry of all kinds are to be used only as the greatest of luxuries, and therefore in small quantities and at long intervals. The community can only become healthy as individuals become healthy, and all the reforms necessary to make Memphis and Granada places in which yellow fever never comes may be adopted; but if the control cannot be obtained of the bodies of, and the modes of living of the individuals in those and all other places, evils not so suddenly fatal, but none the less in the end dangerous, and all the time injurious to their well being, will certainly exist.

A PLAN TO MAKE NEW YORK A FRESH WATER PORT.

Mr. James Cochrane, "formerly of the U. S. Navy," gravely proposes to convert New York harbor into a mill-pond, for the benefit of commerce and the improvement of public health.

His plan is not very coherently presented in the pamphlet he sends us, but it is possible to make out several of the changes he wishes to effect.

In the first place, he would build at the Narrows, and at Throgg's Neck, on the Sound, artificial dams with locks, which would shut out the ocean tides and convert the bay and the waters communicating therewith into a many-armed fresh water lake, with a level five or six feet above the present level of the water at high tide.

Among the benefits promised by the change are these:

The vast area of flats along the Jersey shores would be permanently flooded, putting an end to their malarious exhalations.

The depth of water could be regulated, and would be uniform, thus saving that portion of the large expenses involved in handling freight at the wharves, due to rising and falling tides.

The danger and cost of ferry bridges would be obviated, with much of the difficulty and danger now attending the navigation of ferryboats.

The water of the port would be fresh, and fatal to barnacles and ship worms, making the port a desirable one for slipping awaiting freight.

The flow of the river would be steadily toward the sea, so that the tedious anchor watch might be dispensed with.

The surplus water could be used as the source of mechanical power.

The aggregate saving promised for the plan proposed amounts to millions of dollars every year, and millions of lives in time not stated. But the greatest benefit is modestly withheld. In comparatively few years the vast areas of waste water from Newark Bay to Throgg's Neck would be filled up by river silt, and under proper cultivation would furnish all the garden truck required by the surrounding cities. The value of such reclaimed land would be enormous; while the narrow channels that would carry off the inflowing fresh water would probably be ample for the needs of all the commerce that would seek New York as an inland port.

A ZOOLOGICAL NOVELTY.

The first elephant born in this country made its appearance, March 10, in the elephant house of Cooper & Bailey's circus in Philadelphia. It was a female, 4 feet 6 inches long, 35 inches high, and weighed 213½ pounds. The event was not unexpected, though the period of gestation—twenty months and twenty days—was somewhat briefer than was anticipated.

The mother, Hebe, sometimes called "Baby," is one of the five performing elephants whose tricks have been witnessed by circus-goers in every large town in the country. She is 23 years old, weighs 8,000 pounds, and was imported from Ceylon in 1865. Her keeper suspected her condition over a year ago, called the attention of several Philadelphia scientists to the fact, and arranged for examination, which was made by Professor Joseph Leidy, of the University of Pennsylvania; Professor Penrose, of the University of Pennsylvania; Dr. Brinton, of Jefferson College; Dr. F. F. Maury (now deceased), of Jefferson College; Professor Allen, of the University of Pennsylvania; Dr. Henry Chapman (coroner's physician), of Jefferson College, and a number of other eminent physicians. It was then decided that the period of gestation would be complete about the middle of the present month. Naturally the event has not lessened the interest which physicians and naturalists have taken in the case, and it is probable that a paper on the subject will

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be presented to the Academy of Natural Sciences of Philadelphia.

The mother and infant are both doing well, the latter sucking like any other mammal, folding its trunk back over its head, as described by all reputable naturalists. The birth of elephants in captivity is not an uncommon occurrence in India. Unfortunately no one appears to have been present to witness the accouchement.

CHEMICAL REPULSION.

In a paper read on the 13th of January before the Royal Society, Dr. E. J. Mills claimed to have discovered a new order of chemical phenomena, which he has provisionally designated as "chemical repulsion." If a thin layer of a solution of chloride of barium be distributed evenly between two plates of glass placed horizontally (excess being removed by pressing the plates together), and then dilute sulphuric acid be brought into contact with it through a perforation made in the upper plate, precipitation takes place and continues progressively and uniformly from the perforation as a center; forming an increasing circle, for instance, if the perforation be circular. If the sulphuric acid be introduced through two perforations in the upper plate, two circles are formed, but as their circumferences approach each other development is retarded between the perforations, the figure of advance being no longer circular, but oval, and, however long the experiment may be continued, there always remains a line of demarkation of "no chemical action" between the two figures. When there are perforations at the four points of a square and one in the center, the center circle, having, as it develops, no way of escape from the surrounding four, eventually forms a square figure bounded by repulsion lines. Dr. Mills considers that the phenomena observed afford proof of two propositions: (1) That chemical action can take place at a distance; and (2) that two or more chemical actions, identical except in position, completely exclude one another.

Statistics Versus the "Big Farm Scare."

A great deal has been said about the multiplication of big farms in this country, and doleful predictions have been uttered by those professing to believe that the United States are destined to repeat the experience of England and Ireland in the monopoly of the land by a few. That there is no real danger of such an issue is clearly shown by the following statistics, which the *Tribune* compiles from the several census reports.

In 1850 the average size of farms in the United States was 203 acres; in ten more years the average was four acres less, and at the last census a further reduction of 47 acres appeared, and farms averaged only 153 acres. The decline between 1860 and 1870 was so general that the only exceptions in all the States and Territories were—an increase in California from 466 to 482 acres, from 94 to 133 in Massachusetts, and from 25 to 30 in Utah. Prior to 1850 land monopoly had some claim to existence in California; in ten years the average size of farms was diminished by a reduction of just 4,000 acres! In Texas the reduction was in the first decade from 942 to 591 acres, and in the second to 301 acres. The next census is expected to show a further decline. Minnesota had 157 farms in 1850, 18,181 in 1860, 46,500 in 1870, and now claims more than 68,000, and her farmers are not much frightened in view of the competition of half a dozen "monster" wheat farms! There were 5,364 farms of more than 1,000 acres each in 1860; in 1870 there were only 3,720. In the same period the number from 500 to 1,000 acres declined from 20,319 to 15,873, while all the classes of smaller farms increased, the ratio of increase getting larger as the scale of size descended.

The Mind in Eclipse.

At a recent meeting of the Medico-Legal Society, in this city, Dr. George M. Beard read a paper on "The Problems of Insanity," in which he said: "It is a paradox of astronomy that the sun may best be studied during an eclipse; and in psychology the mind may be studied best when it is eclipsed.

"Insanity is a disease of degrees; there is no plain dividing line between sanity and insanity. Insanity may be divided into two kinds—intellectual insanity, embracing forms in which there are delusions, and emotional insanity, in which there are no delusions. Insanity is a barometer of civilization, and as we advance higher in the arts and sciences so will insanity become more prevalent among us. Intense application, brain work, and indoor life are the agencies which most frequently bring it about. With savages or barbarians there is little or none of it. The intellectual activity of the women of to-day is another great cause of insanity. What the mother is, so will the child be in an intenser degree.

"Insanity is increasing most perceptibly in Europe and America among the poorer classes. Civilization grinds hardest on the poor, shutting them up in close houses, with bad air and poor food, and compelling them to struggle for existence. The brain cannot always bear up under the strain, for they have few recreations and amusements which can be indulged in for the relaxation of their minds. A diagnosis in cases of insanity is most difficult. The physician must know the subject psychologically; know he thinks, what he thinks, and all about his general disposition, passions, etc. The probabilities of cure in the case of insane persons depend greatly upon the advancement of the disease when the treatment is begun. It is better if the patient can be treated out of the asylum, and if he is not confined or isolated altogether from the world, narcotics and stupefying remedies should not be used when their use can be avoided. Until a comparatively short time our inventions have tended to an increase rather than to a decrease of insanity. Of late, however, the inventions have been in the opposite direction, tending to give us more ease and rest, as, for example, the telephone, elevated railroad, and the electric light. If the latter is perfected, it may also enable us to breathe a purer air. An improved system of education, with less 'cramming,' would tend to reduce the increase of insanity. The eclipse of the mind cannot be predicted like the eclipse of the sun, but, with study, men may learn to detect it in its first stages, and, if treated early, it need rarely become serious."

Artificial Diamonds at Last.

Professor Story Maskelyne, who examined Mr. Jame MacTear's presumed "diamonds," an account of which was published on page 88, present volume, has written the following letter to the London *Times* on those produced by Mr. Hannay:

"SIR: A few weeks since I had to proclaim the failure of one attempt to produce the diamond in a chemical laboratory. To-day I ask a little space in one of your columns in order to announce the entire success of such an attempt by another Glasgow gentleman.

"That gentleman is Mr. J. Ballantine Hannay, of Woodbourne, Helensburg, and Sword Street, Glasgow, a Fellow of the Chemical Society of London, who has to-day sent me some small crystallized particles presenting exactly the appearance of fragments of a broken diamond.

"In luster, in a certain lamellar structure on the surfaces of cleavage, in refractive power, they accorded so closely with that mineral that it seemed hardly rash to proclaim them even at first sight to be diamond. And they satisfy the characteristic tests of that substance. Like the diamond, they are nearly inert in polarized light, and their hardness is such that they easily scored deep grooves in a polished surface of sapphire, which the diamond alone can do. I was able to measure the angle between the cleavage faces of one of them, notwithstanding that the image from one face was too incomplete for a very accurate result. But the mean of the angles so measured on the gonimeter was 70° 29′, the correct angle on a crystal of the diamond being 70° 31·7′. Finally, one of the particles, ignited on a foil of platinum, glowed and gradually disappeared exactly as mineral diamond would do.

"There is no doubt whatever that Mr. Hannay has succeeded in solving this problem, and removing from the science of chemistry an opprobrium so long adhering to it; for, whereas the larger part of the great volume recording the triumphs of that science is occupied by the chemistry of carbon, this element has never been crystallized by man till Mr. Hannay achieved the triumph which I have the pleasure of recording to-day. His process for effecting this transmutation, hardly less momentous to the arts than to the possessors of a wealth of jewelry, is on the eve of being announced to the Royal Society.

"I am, Sir, your obedient servant,

"N. STORY MASKELYNE.

"Mineral Department, British Museum, Feb. 19."

Nashville's Centennial.

The hundredth anniversary of the settlement of the city of Nashville, Tenn., will be celebrated by the holding of an exhibition of the arts and sciences, beginning April 23 next and continuing until May 29.

The Citizens' Centennial Commission announce that active preparations are making for a first-rate exhibition, and that a wide-spread interest in the undertaking is already aroused, giving promise of a display which shall excel anything Nashville has seen before. The Exhibition buildings are in the heart of the city, easy of access, and amply provided with facilities for the display of manufactures, machinery in motion, inventions, works of arts, and natural products.

The reception of exhibits will begin April 5 and close April 22. Exhibitors of running machinery are requested to have their exhibits in place by April 17. Applications for space should be made to Mr. B. J. McCarthy, chairman of the committee on assignment, space, etc., and for general information to Dr. G. S. Blackie, corresponding secretary, Nashville, Tenn.

Manufacturers of articles finding or seeking a market in the South will find this a good opportunity for placing their wares before a large and thrifty portion of the Southern public. Nashville is not only an important railway center, but is in the heart of a region rapidly increasing in commercial and manufacturing importance. No premiums are offered, and there is no charge for space.

An International Leather Show.

An International Exhibition of leather and leather goods, furs and pelts, tanner's materials, shoe and leather machinery, and the like, is contemplated from May to November, 1881, at Frankfort-on-the-Main. The circular of the provisional committee states, that this exhibition is intended to bring together from all parts of the world all the different raw materials, and to show in successive stages the manner and means of their being manufactured and adapted to the wants of man. It will show how art and science and labor and capital have been constantly and quietly working for the advancement of civilization in this industry, fully as much as in any other.

Frankfort-on-the-Main has been selected as the central city of Germany, and a committee composed of prominent men in the principal industries, with men of science and art, will do all they can to make it a most complete and successful exhibition.

Steam Dredges Wanted for Erie Canal.

State Engineer, Horatio Seymour, Jr., reports the serious filling up of the State canals and the great need of steam dredges for the removal of the accumulating mud.

Many streams empty into the canals, carrying in time of freshets a large amount of mud and gravel. Every city and village along the line pours in more or less sewage. Offal is thrown out from boats, and through every city and village ashes and every other rubbish are thrown into the canal. This material which accumulates during the year, as a rule, must be within a few days removed in the spring. Every year a portion of this deposit is taken out, but the time is so limited, and the difficulty of handling it is so great, that there is not as much removed as comes in.

The consequence is that the canal has gradually been filling up. In order to allow boats to draw 6 feet of water, the levels of the canals have been raised, making it necessary to lift up the bridges to allow boats to pass under. The Erie survey of 1876 showed that the bottom of the canal had been worn away in the center under the boats to more than 7 feet in depth, but at the sides deposits existed varying from 6 inches to 2 feet high, and extending over one half of the bottom. The amount of this deposit was estimated to be about 900,000 cubic yards. This has increased since that time to about 1,000,000 cubic yards. Last spring a great effort was made on all the divisions to clean out the prism, but the time was so short (18 days) that not more than 100,000 yards were removed. Although but a small part of the whole deposit was removed, this work had a marked effect upon navigation, as the boatmen will testify. The whole of this material can be taken out by dredges, in the summer, without interfering with navigation, in four years, at a cost of about 12 cents a cubic yard, which will give to the canal a uniform depth of 8 feet. Experience shows that it cannot be well removed by hand, except at very great cost. Last spring, $30,000 was spent on the Western Division for removing deposits. This sum would have purchased a dredge and paid the expenses of working it two years. The Champlain Canal is in an especially bad condition.

Household Water Motor.

In Zurich, Switzerland, the use of a portable water power, so to speak, is being extensively used for household purposes. Firewood, for example, is to be sawn into convenient lengths for burning. A small sawing machine on wheels is drawn by two men to the front of a house. They connect by a flexible tube with the nearest hydrant; the water flows to the machine; the saw dances, and cuts up the wood with surprising rapidity. A portable turbine has also been invented, and employed in many places in the same city, in driving a Gramme machine for the production of electric light. Water is very abundant in Zurich; but there are other towns in which this domestic water power could be advantageously introduced. Where it is any object to keep a record of the water used an indicator showing the quantity might be affixed to the machine.

The Best Fire Apparatus.

Norwich, Conn., is supplied with water from an artificial pond three and a half miles from the city. It is brought to the city in pipes by gravity pressure. The city is provided with two way hydrants located not more than 600 feet apart. A water pressure is obtained at the hydrants equal to 85 lb. to the square inch, which will throw an effective fire stream over any building in the place. Chief Carrier relies entirely upon the hydrant pressure. He uses four-wheel hose carriages, 600 feet of hose on each reel, and twenty men to each company. He has four steamers, but they only respond to second alarms, and have not been called out in a year and a half. The department controls all fires by means of the hydrant streams. This is the cheapest and best fire service to be obtained—fire streams direct from hydrants. Cities putting in waterworks should keep this point in view.

Onions.

From our own experience, and the observation of others, we can fully indorse the testimony of the St. Louis *Miller*, on the healthful properties of the above esculent. Lung and liver complaints are certainly benefited, often cured, by a free consumption of onions; either cooked or raw. Colds yield to them like magic. Don't be afraid of them. Taken at night all offense will be wanting by morning, and the good effects will amply compensate for the trifling annoyance. Taken regularly they greatly promote the health of the lungs and the digestive organs. An extract made by boiling down the juice of onions to a sirup, and taken as a medicine, answers the purpose very well, but fried, roasted, or boiled, onions are better. Onions are a very cheap medicine, within everybody's reach, and they are not by any means as "bad to take" as the costly nostrums a neglect of their use may necessitate.

M. THOLLON has recently observed, by the aid of his spectroscope of high dispersive power, a solar protuberance whose height equaled one-sixteenth of the diameter of the sun, or about 55,000 miles.

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NEW PLASTERING MACHINE.

The annexed engraving represents a novel and simple tool which is intended to replace the hawk and trowel ordinarily used for plastering walls, and to facilitate the operation, so that a greater amount of work can be done in a given time than with the ordinary tools.

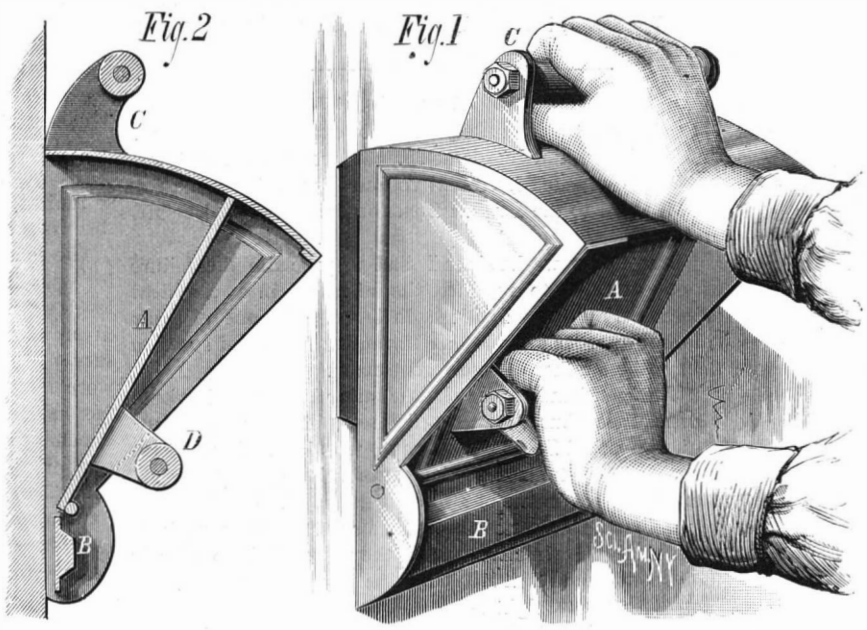
The mortar receptacle is made in the form of a segment of a cylinder, and has a movable leaf or presser plate, A, pivoted near the gauge bar, B. The tool is grasped by the handle, C, attached to the convex end, and by the handle, D, projecting from the movable plate, A. The edges of the mortar receptacle are rounded at the ends to form runners which guide the tool smoothly over the wall. The gauge bar, B, is made adjustable to regulate the thickness of the coating applied to the wall.

When the presser plate, A, rests against the ledge at the rear edge of the curved end of the tool, the receptacle may be filled with mortar. The machine is then applied to the wall with the gauge bar downward, and, as it is moved upward, pressure is applied to the plate, A, through the handle, D, when the mortar will be forced out of the narrow opening at the bottom.

The inventor informs us that a workman using one of these machines can perform the work of two men using the ordinary tools, and the work will be done with greater uniformity.

Fig. 1, in the engraving, shows the manner of using the tool, while Fig. 2—a transverse section—shows the arrangement of the presser plate, A, and gauge bar, B.

This useful tool was recently patented by Messrs. G. Stevens and E. F. Guild. Any further information may be obtained by addressing Mr. Egbert F. Guild, East Saginaw, Michigan.



GUILD'S PLASTERING MACHINE.

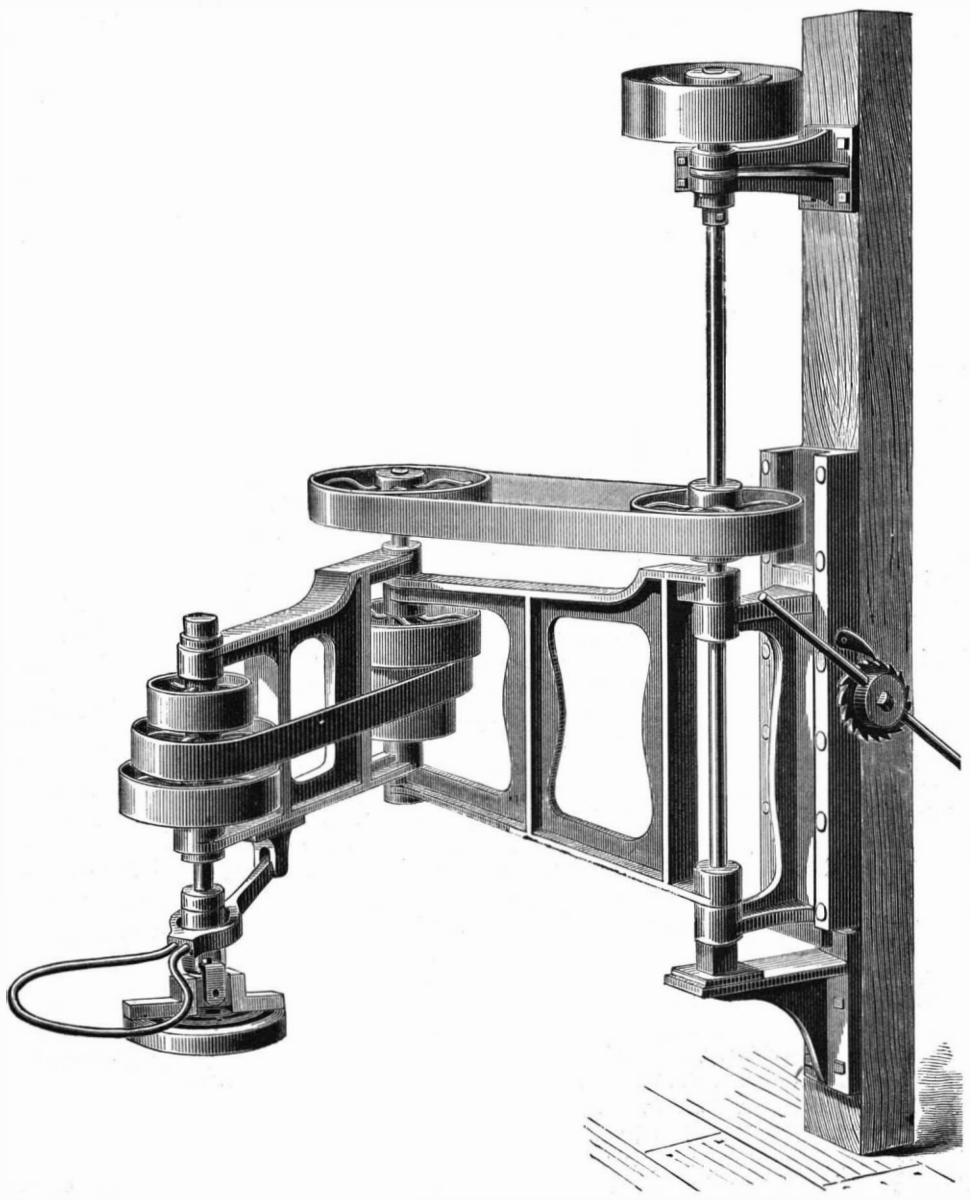
IMPROVED STONE POLISHING MACHINE.

Our engraving represents an improved machine for polishing all kinds of stone, but more especially adapted for polishing different varieties of granite and heavy blocks of marble. It is new in design, and combines many valuable improvements which render it very efficient. Beside a vertical movement of the entire machine, which adapts it to stone blocks of different heights, the polishing disk may be moved up or down within certain limits, to increase or diminish the pressure on the face of the stone or to stop the action of the polishing disk altogether, if necessary. The polishing disk is connected with its spindle by a universal joint, so that it may adapt itself to slight inequalities in the surface of the stone or to a variation of the face of the stone from a true level.

The spindle of the polishing disk is provided with cone pulleys, corresponding to the cone pulleys on the countershaft in the joint of the arms, so that the speed of the spindle may be varied to suit polishers of different sizes, and to adapt it to both roughing and finishing.

The journals are provided with heater boxes which do away with a great amount of friction. The polisher works on a half circle of twelve feet and will polish work ten feet long. The work may be arranged so that, while polishing one stone, another can be placed in position. The machine is supported by a single vertical post; and may be very easily set up. It is made wholly of iron and steel, and is well calculated for the work it is intended to perform.

Further information may be obtained by addressing the patentees and manufacturers, Messrs. M. Wright & Son, Montpelier, Vt.



WRIGHT & SON'S STONE POLISHING MACHINE.

The Buffalo Pipe Line.

The Buffalo Pipe Line Company have secured a right of way from the Bradford District to Buffalo, N. Y., and expect to have the line in operation by June. The main line will be about 65 miles in length, the pipe 4 inches in the clear, and requiring about 7,000 barrels of oil to fill it. The line will begin at a point near the State line, in the town of Allegany, Cattaraugus county, and its route will be through the towns of Allegany, Humphrey, Franklinville, Ellicottville, and Ashford, in Cattaraugus county, and Springville, Concord, Boston, East Hamburg, and West Seneca, in Erie county, to Buffalo. There will be two pumping stations, one at the starting point, and the other midway between there and Buffalo. Tankage will be provided at the latter place for the storing of about 1,000,000 barrels crude oil.

Our Lakes.

The latest measurements of American fresh water seas are thus given: The greatest length of Lake Superior is 335 miles; its greatest breadth, 160 miles; mean depth, 688 feet; elevation, 627 feet; area, 82,000 square miles. The greatest length of Lake Michigan is 300 miles; its greatest breadth, 108 miles; mean depth, 690 feet; elevation, 506 feet; area, 20,000 square miles. The greatest length of Lake Huron is 200 miles; its greatest breadth, 169 miles; mean depth, 600 feet; elevation, 274 feet; area, 20,000 square miles. The greatest length of Lake Erie is 250 miles; its greatest breadth is 80 miles; its mean depth is 84 feet; elevation, 555 feet; area, 6,000 square miles. The greatest length of Lake Ontario is 180 miles; its greatest breadth, 65 miles; its mean depth is 500 feet; elevation, 261 feet; area, 6,000 square miles. The length of all five is 1,265 miles, covering an area upward of 135,000 square miles.

The Magnet in Milling.

Magnets and magnetic separators are a comparatively new thing in milling; but perhaps there is no contrivance employed in our mills, whose utility is so unquestioned, or which has grown into such wide use in so short a time, as the magnet in the forms of gangs and separators. Since they have become a necessity in our mills, many a time when looking over the assortment of iron taken from his wheat, has the miller wondered why people never thought of using magnets before as a means of cleaning wheat.

Millers will remember the commotion which the introduction of the wire binder caused. And there was good reason for the opposition which millers manifested to the use of the wire binder by farmers. Many, who at first sight saw nothing objectionable in wire-bound wheat, were soon loudest in their clamors against it. They had relied upon cleaning machinery of unquestioned excellence to remove what bits of wire should chance to find their way into the wheat; but time soon showed that the crooked little pieces of wire would work their way through the best cleaning machinery, thence go to the burrs, where they were flattened out into saws, and then to the bolts, where they played havoc with the cloth. In some sections, where the wire binder was exclusively used, bits of wire could be traced even into the bread, and be found in an incomprehensible abundance in all mill products. It got into the bran and choked cattle fed on it. It blackened the burrs and destroyed the bolting cloth. In fact, wire in wheat became an unbearable nuisance in spite of every precaution against it—and then came the magnet.

Never did so simple a remedy cure such wide-spread disaffection. Millers' associations had tabooed the wire binder and passed resolutions favoring a discrimination in price against wire-bound wheat. This journal had declaimed against it until it felt hoarse; but the magnet removed every objection to the wire binder by taking out the insidious bits of wire. Every miller who tried the remedy was satisfied, and the clamor ceased. The truth is, that the introduction of magnets as a grain-cleaning agency opened the eyes of millers to a few facts of which they had been ignorant before. They had been perfectly cognizant of the damage done by wire in wheat, but no one expected such a revelation as the use of magnetic separators gave us all. Most of us knew that the magnets would show that wire existed where its presence was never suspected; but who would have looked for such a collection of metallic odds and ends as these separators bring to light? In the course of a day a large merchant mill will take from its wheat, by means of magnets, a miniature junk shop. You will find everything represented, from tenpenny nails down to bits of iron as small as a pin head. How all of it got into the wheat is a mystery; but one thing is certain, that much of this iron must formerly have gone to the burrs and bolts; and, if the wire binder had never been invented, magnetic separators would find a useful place in every mill. But the wire binder has come to stay. Revolutions do not go backward; and it is not at all likely that the farmer will ever again rely upon "tramp" labor in harvest after once having had his wheat gathered by one of these binders. Therefore we must expect wire in our wheat along with nail heads and other rural products. So far, the magnet is the only effective means discovered, by which the miller can remove wire from his wheat; and, therefore, the magnet and magnetic separators are probably as much of a permanency in milling as the wire binder is in agriculture.—*American Miller.*

INTELLIGENT WORK PAYS: Eight years ago Wisconsin's butter and cheese product was worth $600,000; in 1879, it was worth $2,500,000, and during this time the State has advanced from no standing to the first rank in the markets of the world. This profitable progress is justly attributed, by the *Jefferson County Union*, very largely to the educational influence and fostering care of the State Dairymen's Association, and promoting exhibits at the Centennial in Philadelphia, and at the two International Dairy Fairs at New York.

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MISCELLANEOUS INVENTIONS.

Mr. John Hill, of Columbus, Ga., has recently patented an improvement in the class of fire extinguishers employed in large buildings, in which a stand pipe is connected by branch pipes and valves with a set of sprinkling pipes in each story, whereby the water may be showered down in any room or compartment in which a fire may take place. The invention consists, mainly, in connecting the valves of each branch pipe where they join the stand pipe and lead to the several stories with a common station by means of shafts and toothed gears, and providing a handle or hand wheel on each floor with the valve, whereby the turning on of the water from the stand pipe to the branch pipe of any one story may be effected either upon that floor or from a common station below.

Mr. William Brown, of Greenpoint, N. Y., has patented an improvement in the class of barrel lifters consisting of a hoop and two clamps, the latter being pivoted to opposite sides of the hoop and provided with handles. This useful invention was fully illustrated and described in our columns not long since.

Mr. Upton Miller, of Mount Morris, Ill., has patented an improved washing machine. This invention relates to that class of washing machines in which the clothes are compressed between reciprocating pressing boards.

Mr. Christopher G. Dodge, Jr., of New York city, has patented an improved calcimine, or distemper paint consisting of Paris white, glue, white soap, chloride of calcium, carbolic acid, and water, mixed in certain definite proportions.

An improved gag-runner for harness, which is so constructed that they may be readily adjusted higher and lower, and may be conveniently attached and detached, as required, has been patented by Mr. Marshall R. Dowlin, of North Adams, Mass. The invention consists in the combination of a metal hook with the loop of a gag-runner.

An improved beehive, patented by Mr. Erasmus H. Key, of Mayfield, Ky., is provided with better arrangements or provisions for the health and comfort of the bees and for the convenience of the bee-culturist than those ordinarily in use.

Mr. John R. Roberts, of Youngstown, O., has patented a towel rack formed of a single piece of wire having its end parts bent to form the brackets and the bearing loops for the roller.

An improved recording apparatus for spirit meters, patented by Mr. John M. Cayce, of Thompson's Station, Tenn., is mainly an improvement upon letters patent of the United States No. 211,554, granted to the same inventor January 21, 1879.

An improved clasp for albums has been patented by Mr. Sidney Posen, of Offenbach-on-the Main, Germany. The object of this invention is to furnish an improved clasp for albums or other books that may be opened and closed and so held automatically.

Mr. Charles Y. Beach, of Fairfield, Conn., has patented a composition for the manufacture of rubber or other gum cloth or fabrics, consisting of caoutchouc or other gum and cotton or other fiber, prepared by grinding together.

IMPROVED SPROUT PULLER.

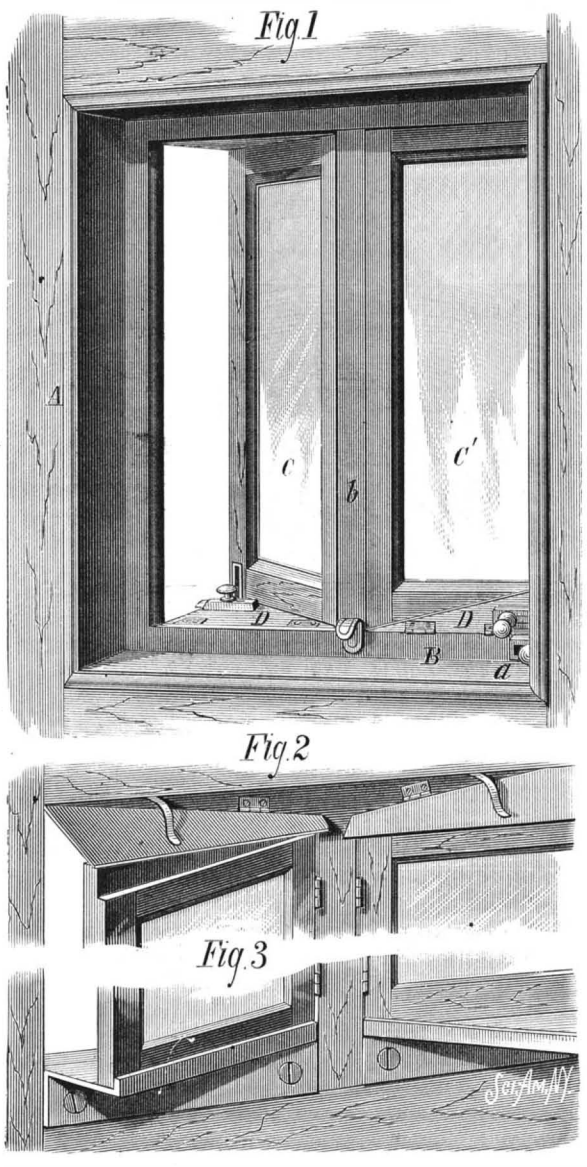
Sprout or grub pullers, as commonly made, have sharp jaws, which are liable to cut or break the sprout, and they are otherwise inefficient and inconvenient. The annexed

SNAPP'S SPROUT PULLER.

engraving represents an improved puller patented by Mr. James W. Snapp, of Jasper, Tenn., and designed to avoid the imperfections of its predecessors. It has two rounded jaws, which are concaved laterally on their grasping surfaces to prevent cutting or breaking the sprout. One of the jaws is curved and attached to a fulcrum block having a rounded bearing surface, which is large enough to furnish a steady support. The manner of using the tool is clearly represented in the engraving.

IMPROVED CAR WINDOW.

The car window shown in the engraving is especially designed for sleeping and drawing-room cars, but it is equally well adapted to ordinary passenger cars. It makes an effective ventilator, and at the same time prevents the entrance of smoke, dust, cinders, and rain without in any way obstructing the view.



MACKALL'S CAR WINDOW.

Fig. 1 is a perspective view of this improved car window; Fig. 2 shows the upper portion of the window, and Fig. 3 is a modified form of the device shown in Fig. 1.

The car window frame, A, contains the sash, B, provided with a vertical center bar, *b*. To this bar are hinged two sashes, C C′, opening in opposite directions. These sashes may be closed flush with the sash, B, so that the entire window may be raised in the usual way. To the sash, B, at the lower end of the openings of the sashes, C C′, are hinged the plates, D, which are thrown down as the hinged sashes are opened, and thus close the space between the main sash, B, and the sashes, C C′. Instead of the hinged plates, D, the inventor, in some cases, uses a fixed bent plate, as shown in Fig. 3.

The tops of the sashes, C C″, are covered by triangular water shed plates which are hinged to the sash, B, and open outwardly when the hinged sashes are opened. They are pressed against the sashes by springs secured to the sash, B.

These water shed plates may be constructed like Fig. 3, and are then stationary and fastened to the car window frame.

In going in a given direction only the hinged sashes furthest from the front end of the car are opened. By means of this arrangement the foul air is exhausted from the car as it proceeds, without the entrance of dust or cinders.

Further information may be obtained from Mr. Douglass Green, Columbus, Ga.

Fire-proofing Cotton Fabrics.

In a paper on some conditions of inflammability, read before a sanitary convention in Michigan, Dr. Kedzie, of the State Board of Health, said that cotton clothing could be prevented from taking fire by the use of borax in starching—a teaspoonful to each pint of starch after the water has been added. The borax can have no injurious effect upon the cloth or upon the wearer, and is so cheap that all can afford to use it.

Dr. Kedzie showed by experiments that muslins and tarletans, the most inflammable goods, when treated with borax starch, could not be made to burn with a blaze. If all cotton dresses and underclothing, and especially the clothing of children, were treated in this way, a great number of lives and much suffering would be saved every year.

Dr. Kedzie said he expected that one of these days some shrewd fellow would use this receipt, mix starch and borax, and sell it as "asbestos starch," or with some other catching name, at 500 or 600 per cent profit, and get rich out of it. The people could just as well do their own mixing and save the profit.

Cotton Factories in the South.

Mr. Francis Fontaine, Commissioner of Land and Immigration for the State of Georgia, asserts that no cotton mills in the world have been so profitable as those of Georgia during the past decade. The Chattahoochee River, at Columbus, furnishes one of the best water powers in the world; and at this point are 60,000 spindles in operation. One company at Columbus has a mill employing 1,800 operatives, all natives except the foremen, and manufacture over one hundred varieties of goods. They use 13,000 bales of cotton per annum and 800 lb. of washed wool daily, and pay out $600,000 per annum.

The total number of spindles in the Southern States—687,200—are distributed as follows:

States.	Spindles.
Arkansas	1,700
Alabama	63,000
Georgia	187,000
Kentucky	11,284
Louisiana	6,200
Mississippi	70,000
Maryland	113,000
Missouri	26,000
North Carolina	93,300
South Carolina	92,000
Texas	9,300
Tennessee	49,500
Virginia	52,000

The Climax of Invention.

The Bridgeport *News* very cleverly describes an invention, credited to a Bridgeport Yankee, to prevent marketmen from palming off old eggs for fresh ones. The inventor proposes to arrange a rubber stamp in the nest of every hen, with a movable date. This stamp is arranged with a pad that is saturated in indelible ink. When the hen lays an egg, as is well known, she kicks slightly with her hind leg. An electric disk is arranged so that her foot touches it, and the stamp turns over on the ink pad, and then revolves, stamping the date on the egg. The hen then goes off about her business, the farmer's hired girl removes the egg, and replaces the stamp, which is then ready for another. On each evening, after the hens have retired to their downy roost, with the roosters, the date of the stamp is altered for the next day, and the work goes on. In this way there can be no cheating. You may go to the grocery and ask for fresh eggs, and the grocery man tells you he has some eggs of the vintage of January 29, 1880, for instance. You look at them, and there are the figures, which cannot lie.

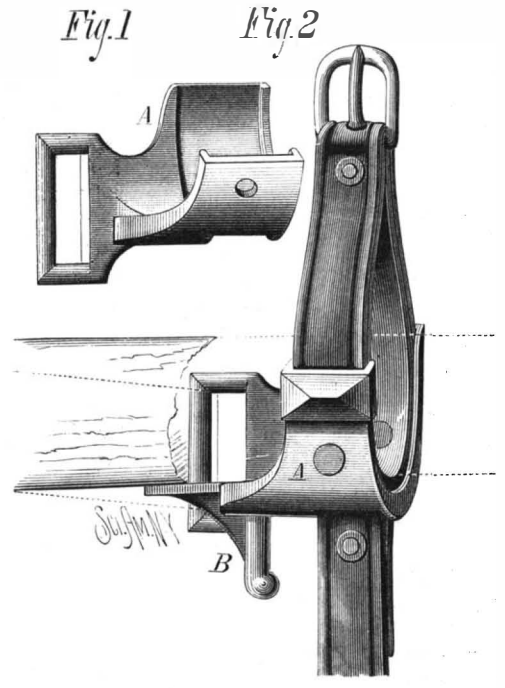
Flooring for Brooklyn Bridge.

The contract for the under flooring of Brooklyn Bridge has been awarded to the proprietor of the Hayford process for the preservation of wood. There will be required about 1,100,000 feet of yellow pine, which will first be thoroughly dried and then charged with creosote under pressure.

NEW HOLDBACK FOR HARNESS.

The accompanying engraving represents an improved holdback lately patented by Messrs. J. Knight and H. Hilliard, of Musquash Parish, New Brunswick, Canada. It consists of a curved metal plate or shell, A, having inwardly projecting flanges forming a seat for the thill strap and having an eye for receiving the holdback strap. The shell has a mortise for the thill strap to pass through, and the rear edge of the shell has a notch for receiving the hook, B, attached to the thill.

This device takes the wear and pressure of the thill and thill hook, and relieves the strain on the girths. It insures



KNIGHT & HILLIARD'S HOLDBACK FOR HARNESS.

the fastening of the breeching, and in case of the breakage of the breeching it prevents the vehicle from running forward against the horse. It gives the horse greater control of the load than the ordinary holdback, and greatly facilitates harnessing and unharnessing the horse. These and many other advantages will be apparent to those familiar with the requirements.

Further information will be furnished by the patentees, whose address is given above.

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AMERICAN INDUSTRIES.—No. 36.

THE MANUFACTURE OF POWER PRINTING PRESSES.—A PRINTING PRESS MANUFACTORY—COTTRELL & BABCOCK.

Probably no single feature of our Centennial Exposition, in 1876, occasioned greater surprise to foreign visitors, as well as many of our own people, than the department in which were exhibited copies of over 8,000 different American newspapers. It was a collection which showed, in a way that mere figures could never bring home to the mind, how emphatically we are a reading people. In the first page illustrations of this issue we have sketched the making of the machinery with which many of these newspapers are printed, in a factory, where, also, are constructed machines for the finest letter-press work; in fact, the printing done on these presses includes every variety of what printers know as good work, either in colors or plain black, and from them have been issued some of the most beautiful specimens of the typographic art. The business is one in which American mechanics and artisans have long occupied a leading position, and the establishment we here represent has attained a deservedly high place therein.

It is not our purpose to show by what successive steps, and from what rude original contrivances, the printing press has been brought to its present state of efficiency. Volumes might be written upon this subject. Nor will the mammoth "lightning" presses required by our leading daily newspaper establishments be here considered. Each advance that has been made in the construction of such printing machinery, where fine workmanship was not so much an object as a high rate of speed, has been heralded in the columns of every newspaper in the land. But these large presses, marvels of skill and ingenuity as they are, form only a very small proportion of the number of printing machines which are operated in every city and every large town in the land. For all books, for every description of work in which engravings are used, for printing in colors, and for miscellaneous service, as well as for a great majority of the newspapers of the country, presses are required which, while doing many times as much as could be accomplished by the old hand process, will do a far better class of work than can be obtained where speed is the principal object sought. The SCIENTIFIC AMERICAN, for instance, could not be printed on what are known as the "lightning" presses without utterly destroying its clear and beautiful impression and ruining the work of the artists and engravers who make its illustrations, for the proper presentation of a fine wood engraving not only requires a great deal of time in "making ready," so that each detail of the picture may receive just the right shading and emphasis, but the printing must be done on machines of the greatest exactness, in which each part can be kept to its work with the utmost precision.

In nearly all of this class of printing the types or electrotype plates are secured on a flat bed, which is made to move forward and back under a revolving cylinder, which carries the paper and gives the impression, and with which are connected the rollers for inking. The Adams press, which for many years held the leading position as a machine for book work, differs radically from this plan, and gives the impression with a flat platen, as in a hand press, instead of by a cylinder, the press being very heavy, and working at a comparatively slow rate of speed. Excellent printing can be done on the Adams machine, but it is now fast being superseded by the cylinder presses, and very few new Adams presses are at present being made. It will be readily seen that in running a heavy iron bed plate, of sufficient size to hold the type or the plates of a large newspaper or book form, backward and forward over a track eight to twelve feet long, to make it run even and true to a hair, without any jar, in perfect connection with the large revolving cylinder above it, and so that the heavy impression shall be given each time with entire accuracy and evenness over the whole surface, and to do this work as rapidly as required, with perfect facilities for the even distribution and supply of ink, and the delivery of the printed sheets free from smut or blemish, not only calls for the best of mechanical workmanship, but involves a multitude of details which afford a wide field for the display of practical ingenuity. These are the main points in the working of nearly all power printing presses, but it is only within a few years that they have been so improved as to do their work as well as at present, with so great speed and so little trouble in arranging for each successive form.

For the attainment of these ends, the invention by Mr. Cottrell of his device for controlling the momentum of the cylinder was of great practical utility. Previous to its introduction, the impression cylinder, always turning one way, would at times drive the bed with which it is geared, and again be driven by it, its reversed motion at each end of the track making its speed uneven, and thus destroying that exact working which is a prime necessity for the impression cylinder. To remedy this evil Mr. Cottrell introduced an automatic device for checking the momentum of the cylinder as the bed is retarded, thus keeping the gears up to the work side of the teeth, and harmonizing the motion of the cylinder with the irregular speed of the bed. With this patented friction motion improvement a higher rate of speed is attainable, and a more perfect "register," as printers style the printing of the matter each time exactly where it is meant to go on the paper, and generally making the reading on one page exactly in a true line with that printed on its back.

Of yet greater importance, however, to the smooth working of the press, without jar or an excessive amount of wear and tear, was Mr. Cottrell's patent air spring for stopping and reversing the bed. This has been heretofore described, with illustrations, in the SCIENTIFIC AMERICAN, at the time the patent therefor was issued, and its practical success on presses to which it has since been fitted has fully justified all the estimates as to its value which its inventor then put upon it. All the other movements in a press, except that of the bed, are rotary, but for high rates of speed powerful springs are necessary at each end of the track on which the bed travels, to check and reverse its motion. Mr. Cottrell has made perfect air springs for this purpose, so that a plunger, with an ingeniously fitted and adjustable packing, shall work into an air cylinder; the latter is provided with an automatically working vent at its head, which destroys the vacuum at such point on the return motion as will prevent any suction on the withdrawal of the plunger, and, the exact amount of momentum it will require to compress a given amount of air to a certain density being easily demonstrable, it is thus a simple matter to adjust the air spring as may be required for a light or heavy form on the bed, or for a greater or less rate of speed. The weight of the bed, however, is so much greater proportionately than that of any type form, that a scale showing pressures to which the gauges for the air spring should be set for different rates of speed has been made, and is now fixed on a plate on each machine.

For instance, the plate on a four roller, two revolution press, with a bed 35 by 52 inches, reads:

Set plungers so gauges shall indicate—

For 800 impressions an hour, 15 lb. square inch.

" 1,000	"	"	"	20	"	"	"
" 1,200	"	"	"	30	"	"	"
" 1,400	"	"	"	40	"	"	"
" 1,600	"	"	"	45	"	"	"
" 1,800	"	"	"	50	"	"	"

From 2,500 to 3,000 lb. resistance is necessary to overcome the momentum of the bed of such a press, working at a speed of 1,600 impressions per hour, and in no other way it is believed has it been found possible to so adjust the resisting force to the needs of the work so advantageously as is effected in this device. In connection with this air spring, also, Mr. Cottrell has obtained another patent for a "governor attachment," whereby, when the press is started, the spring is automatically put on as the speed progresses, or taken off when it is diminished, or when stopped the bed will come gently to rest. To any printer who has been accustomed to the working of presses with the old style springs, the ease and readiness with which the motion of the bed is controlled, with the aid of these two inventions, no matter what the rate of speed, or how variable it is, seems at first quite marvelous.

Another valuable invention of Mr. Cottrell was his patented device for an improved sheet delivery, as shown in Fig. 1. Previously the delivery of sheets, after the impression had been taken, was effected by a complicated arrangement of wheels and tapes, which had to be readjusted for each new form, and any carelessness in which was likely to cause the ruin of the edges of the types or engravings of the form. By this device the tapes are dispensed with, much time is saved in "making ready," and the sheets are delivered free from smut.

The "Hinged Roller Frame," which is also a patented device of Mr. Cottrell, is shown in Fig. 2, A representing the frame for the distributing rollers, as turned back for convenience in handling or adjusting the form rollers, B. When the press is working these distributing rollers are turned down upon and revolve and vibrate in connection with the form rollers, but they may be swung clear by a single movement, and removed without unscrewing the boxes, or will be again locked in place by the downward movement of the frame. The invention covers one of those important details in which pressmen often lose a good deal of time, which by this device may be saved.

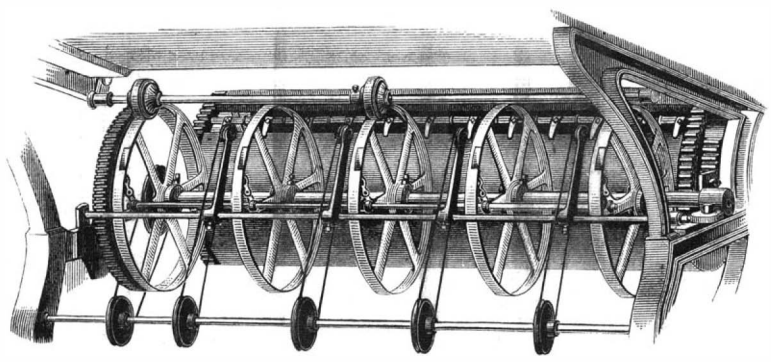

Fig. 1.—COTTRELL'S PATENT SHEET DELIVERY AS APPLIED TO THE COTTRELL & BABCOCK POWER PRESSES.

In the engravings on our first page the picture at the top represents the department in Cottrell & Babcock's factory where the large or "drum" cylinder presses are put together, and where much of the detail in finishing the several parts as they come from the foundry is attended to. These presses with large cylinders do not work as fast as those with smaller cylinders, but, with the improvements which have been introduced, they are capable of doing a great variety and most excellent quality of work while being run at a speed which was not formerly attainable.

In the view given in the middle of our large engraving at the left hand side is shown the room for the construction of what are known as "country" presses. These machines are designed as far as possible to meet the wants of printing offices in places where the business is not yet fully developed, and where a few hundred dollars in the price of a machine is one of the leading considerations. There is a great demand for such presses, for in every small town throughout the country which has its newspaper, the proprietor, if he have only a hand press, which is what a great many of them use, is looking forward to the time when his own circumstances and the growth of his town shall warrant him in "coming out" with a power press.

At the bottom of our illustration is shown the department where the presses of latest design and most improved construction are made. The "two revolution" press, as its name indicates, has two revolutions of the impression cylinder for each printed sheet. It is solidly built, and can be run at a speed of from 1,500 to 2,000 impressions per hour, at the same time doing first-class work, either on illustrations or in color printing. It runs smoothly on compensating bearings, which allow for wear so as to maintain uniform accuracy, and, with the various patented improvements which Mr. Cottrell has introduced affords a "working" machine of acknowledged desirability in any first-class printing office. The "stop" cylinder press, however, represents the very highest attainment in this class of machines for the production of the higher grades of work. The cylinder makes but one revolution for each impression, stopping for each sheet, while the motion of the bed continues; the latter has four separate bearings directly under the point of impression, giving absolute solidity, and the sheet is so fed on the cylinder, while it is at rest, as to insure a uniformly perfect register. The ink distribution is very thorough, as it must necessarily be in all fine work, and the impression can be adjusted to a hair. The firm call this machine the *ne plus ultra* of printing machines; but, although so much has already been done in the way of improving printing presses, we are not disposed to concede that the end has yet been reached, thoroughly excellent as this press is.

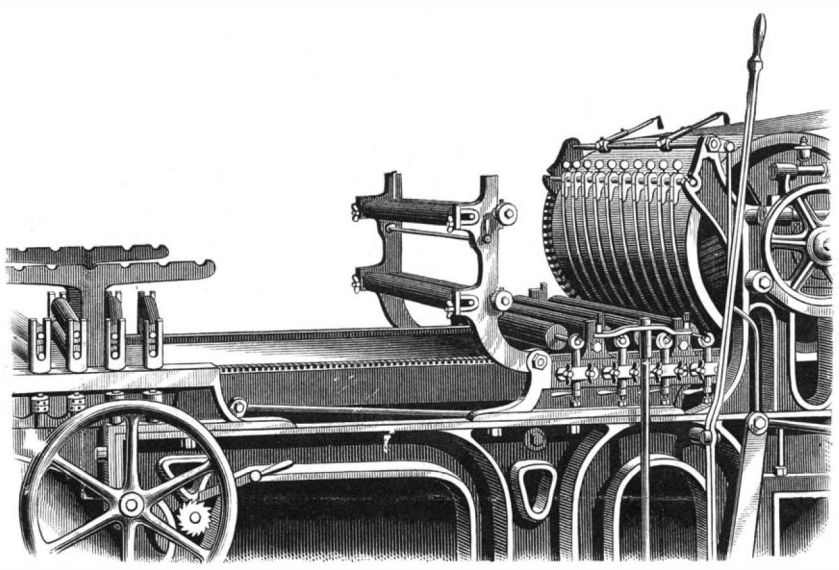

Fig. 2.—COTTRELL'S PATENT HINGED ROLLER FRAME, AS APPLIED TO THE COTTRELL & BABCOCK POWER PRESSES.

The "perfecting" presses made by the firm, for printing both sides of the paper while the sheet is going through the press, is built with a cylinder for curved stereotype plates for reading matter, *over* the drum cylinder, around which the paper afterward passes and receives an impression from the form on the flat bed, where the illustrations and more difficult matter are supposed to be made up. This machine is especially designed for the large illustrated weeklies, in many of which our readers will notice how common it is to have two or more pages with pictures and two or more without, all through—this arrangement coming from the fact that all the engravings are, so far as possible, printed on one side of the sheet of paper, after the other side has been printed, sometimes on a less expensive press. The engravings in this paper, it will be observed, appear with the type matter on nearly all of the pages.

In the general view at the right hand in the middle of the

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page is a good representation of the various buildings in which these presses are made at Westerly, R. I. The most prominent building at the right in the picture is the main structure, to the left of which is the pattern shop, while in the rear are the foundry, blacksmith shop, engine room, etc. The buildings cover about two acres of ground, and the location is a most admirable one, on the Pancatuc river, about five miles above Stonington, where coal and iron can be brought direct to the firm's docks, and from whence their heavy machines may be shipped, at but a small cost for freight.

Messrs. Cottrell & Babcock have obtained nine different patents and two reissues, all but one of which were for inventions of Mr. Cottrell, who has devoted all his energy and ingenuity toward perfecting power presses.

The business offices of Cottrell & Babcock are at No. 8 Spruce street, New York, and 112 Monroe street, Chicago, Ill.

The Wire Age.

Whenever, in walking or riding through the streets of our great cities and towns, the eye is directed upward, a perfect network of wires is seen stretching from building to building and from chimney to gable. The appearance is as if some huge spider had been at work silently and covered in the compact city, holding it a prisoner in the meshes of its met. The view is bewildering, and it seems impossible that any practical or important use can be made of these iron wires, so numerous as almost to shut out the sunlight. It is but little more than thirty years since only a single one could be seen connecting some important building with another in a distant city, by which telegraphic communication was maintained; and forty years ago not even one was visible anywhere. We live in the *wire age* of the world's history, and a most interesting and wonderful epoch it is. We know that these iron filaments subserve the purpose of nerves of thought and sensation, and over them, or through them, the world's commerce is carried on. In the human organization we know that if any accident or event happens to the extremities, the fleshly nerves transmit instantly the news to the seat of sensation, the brain; and so it is with the iron nerves in the external world, which science has arranged; not an event of importance can transpire in any part of the globe which is not instantly "*wired*" to the great cities, and the news spreads everywhere with the rapidity of thought.

Until within the past four years, the wires were capable only of transmitting signals of a complex nature, but easily understood and interpreted by experts; now, human beings talk with each other over the iron, and it seems to make, as it were, a unit of the great family of man. Words, actual words, produced by the organs of speech, are ever winging their way, with the speed of lightning, over cities, across rivers and mountains and woods, and voices are recognized scores of miles away. The wires needed in cities for transmitting fire and burglar alarms, for police calls, time signals, and other municipal purposes, are many in number; and when to these are added the wires for telegraphic and telephonic purposes, the question of space or room for them becomes an important one. These wires must all be independent of each other; there must be no contact anywhere; else serious errors and complications occur. In this city the fire alarm system has been so often interfered with that the chief engineer has called the attention of the city government to the matter.

The time is not far distant when additional wires will become necessary for the purposes of electric lighting, and, perhaps, warming. In the years to come the whole country will be covered with them unless some plan is devised by which electrical currents can be conveyed in the earth by wires protected in tubes of clay or metal. It is certain that some method of this nature must be adopted, and that quite speedily.—*Boston Journal of Chemistry.*

Working Wire.

There are many jobs which require wire, in some one of its many sizes and in some form, as rings or springs, to complete them. Improperly treated, wire is a very obstinate material, if at all "springy" or possessing temper, either from condensation by drawing, or by hardening, it will not occupy the space or shape in which it is formed, and calculation or experiment is necessary to guide the workman to a satisfactory result. All wire of any stiffness, when coiled, will open or expand, making the coil larger in diameter and longer in stretch. In ignorance or neglect of this quality, a workman once tried to form a spiral spring of wire to play upon a flat rod one inch wide by three-eighths of an inch thick. He wound the wire on the flat rod, and when released the spiral was a sight to make his shop companions laugh. The coil was elegant, but scarcely useful; its short diameter and its long diameter alternated in a beautiful geometric spiral, instead of preserving a straight line. Sometimes it is necessary to make a spiral, or rather a coiled spring, of a certain diameter, to fit a hole, or to fit a rod acting as its core or support. It is impossible to give rules to determine the amount of expansion of the coil in diameter, as the nature of the material is so varying. This variation comes from the stiffness of the wire, the size of the wire, and the material—whether brass, iron, or steel.

In the case of desiring to produce a coiled spring of a certain diameter it is best to try a simple experiment with the specimen of wire to be employed. Wind one or two turns on a rod of the proper size for the core, and then, releasing it, measure the interior of the ring or spiral, and compare with the diameter of the core or rod. Reduce the size of the core or rod to an amount a little more than the difference between the size of the hole in which the spring is to work and the rod on which it was formed. If the wire is of a gauge that when wound on a half-inch rod it will fill loosely a hole three-quarters of an inch in diameter, but when allowed to expand the coil requires a hole seven-eighths of an inch, wind the wire on a rod three-sixteenths of an inch smaller than the half-inch rod. This example may not be definite enough to be made into a rule, but it is given as an illustration. A trial should be made, as before mentioned, by coiling the wire around a core of the estimated diameter, and thus determine the amount of opening or spring of the coil. It may be feasible, in some cases, to anneal the wire before forming it into springs. In this case the wire can be wound to the finish size at once. But with brass or iron wire, the springiness of which depends upon the condensatian of the particles by the drawing dies, this plan is not practicable, as hardening and tempering by heat and water will not restore the stiffness of the wire. But with steel wire it is better to use the wire in an annealed form, making the spring just as it is to be in its finished state, and then tempering it, a process which is described further on.

It is a comparatively easy matter to make a close or expanding coiled wire spring in the lathe. The size of the core rod having been determined, all that is necessary is to keep the winding wire close to the previous coil, and this can be done by hand feeding and guiding. The rod on which the spring is wound is placed on the lathe centers, and one end of the wire secured in the dog end, when the lathe may be started on a slow speed, the wire being led to it by hand. This is a handy way also to form rings, the coil being cut apart either with a file or cold chisel.

But in forming open or compressing springs, there must be greater care employed. The stiffest open spring from a certain size of wire is that which has the interstices of the same space as the wire's diameter; so, such a spring—or rather two of them—may be formed by winding two wires at the same time, making a close spring, doubled. When completed, one is unscrewed from the other. A more open spring may be guided by means of a thin piece of iron with a hole large enough to receive the core on which the spring is wound, the hole being in one end of the piece and the other having a handle attached. A small hole should be made through the piece close to the large hole to receive the wire. In operation the guide is slipped on the core spindle up to the dog end, the wire passed through the small hole, and secured by the dog. Then start the lathe, holding the guide close against the rotating core, pulling toward the operator, and the wire, passing through the small hole in the guide from one side, winds against the guide on the other. It is evident that the thickness of the guide will determine the width between the coils. A still better way of forming an open spring is to use an engine lathe with screw cutting feed. With this the grade of the spring may be determined with great accuracy.

Sometimes it is necessary to close the ends of close coiled springs so as to make a central pull by means of hooks or loops. There is machinery to do this with rapidity, but for ordinary jobs hand work is sufficient. The closing is effected by a gradual reduction of the diameter of the coils at the ends of the spring. Unless the wire is very rigid and obstinate, repeated blows with a mallet, a lead hammer, or a copper hammer will do the work satisfactorily. The open end of the spring should be held at an angle on the bench block, and the hammer wielded, striking backward toward the held end of the spring, the spring being turned in the hand in the direction of the coiling. Before the end is closed, a looped piece of wire should be introduced to form a holder for the end of the spring, the projecting end of the looped wire to be formed into a hook or ring.

Large springs of large wire, which from its size and rigidity cannot be managed during winding by the hand, should be made on a contrivance similar in principle, build, and operation to the tire tenders in the blacksmith shop, or the pipe formers in a tin shop. These consists of two rolls to give a forward motion to the material and another to give the curvature. In spring forming the modifications consist in substituting narrow wheels with a V or segmental groove on their peripheries for the two rolls, which receive the wire, and a guide instead of the back roll to produce curvature. The two grooved wheels should be geared together, so as to turn in opposite directions, and the guide should be a curved piece, standing at an angle to the axial rotation of the rolls or wheels. And this guide should be capable of being set up to the rolls or moved back from them, to determine the diameter of the coil, and should also be capable of being inclined from a vertical position, more or less, to make a close or open spring. The guide should have a lip on its working edge to guide the wire. With such a contrivance, coiled springs of steel rod, a quarter of an inch and more in diameter, may be readily formed.

Sometimes a weak spring is required where a flat forged spring would be costly. In this case a piece of stiff wire of hard brass or unannealed iron may do the work when coiled two or three times around a core, the coiled portion forming the spring, leaving ends to be formed into loops or secured by screw, or left to act on the movable attachment it is to actuate, as a pawl. The principle of such a spring is seen in an extreme form in the U, or main spring, of a gun lock. In this spring the two long arms have little to do with its action, the spring or life being wholly in the curve between the two arms. The wire spring has its curve in one or more complete circles.

Coiled springs of steel wire are tempered by heating them in a box, or piece of gas pipe, in which they are packed with bone dust or animal charcoal, precisely as though they were to be heated for case hardening. If a piece of gas pipe is used, which is very handy in such work, one end should be closed by a screw plug or cap, and the open end luted with clay. When sufficiently heated—the box or pipe deep red—remove the spring, or plunge spring and its receptacle together into a bath of animal oil. Do not attempt water hardening or the use of crude petroleum. If common whale oil is not handy, melt lard and use it while it is liquid. The wire will be sufficiently hard to require drawing. This should be done by putting the spring in a shallow pan, with tallow or animal oil, over the forge fire, and agitate the pan and its contents until the oil takes fire. Take the springs out, and when the oil is burned off cool them in water.—*Boston Journal of Commerce.*

Correspondence.

Lighting Mines by Reflectors.

To the Editor of the Scientific American :

The proverb, "Necessity is the mother of invention," is so trite that its quotation calls for an apology, but its truth has been demonstrated recently in so valuable a way in the prosecution of an important and dangerous work here, that, for the benefit of other workers in like professions—mining engineers—who may meet with similar difficulties and dangers, I give you the result of an experiment in the use of sunlight as a means of illuminating underground workings.

An important part of my work during the past two years has been the construction of a deep adit level, to serve also as a base of development of the vein and a main channel of out-carry for ores extracted on higher levels of the mine, and it has been attended with serious difficulty and danger in consequence of the existence of inflammable gases in the rock through which it passes. Three serious explosions have occurred during the past six months, due to its ignition by workmen using open lights, and eleven persons were very badly burned. Workmen at last reached such a condition of fear of consequences that they could not be induced to take such chances of death, to earn a living, as work in the tunnel offered. Safety lamps would not furnish sufficient light. The question, then, was what safe means of illumination could be used. This question was decided, in a measure, in a peculiar way, and was the direct result of necessity, which compelled me to go into the header of the tunnel to look after a party of men that had just been burned by an explosion. I had recourse to a common looking-glass for a reflector of the sunlight. The result was marvelous. The whole tunnel was a flood of bright daylight—sides, roof, and floor, throughout its entire length of 2,500 feet, and all furnished by such a glass as can be bought in your city shops for a dime. Confidence was at once restored in my workmen, and now, while we can command the sun, we can command more labor than the work will employ.

The conditions of the tunnel and the philosophy of the light are these:

The tunnel is perfectly straight, 6½ x 5½ feet inside of timbers; its course south 36° 15′ west from the mouth; and is ventilated by a current of air forced in by a Burleigh compressor operated on the outside.

The philosophy of the light—its intensity and perfect diffusion—is thus accounted for: The air driven into the tunnel is saturated with moisture in the process of compression, and upon being released in the header, resolves itself into its natural volume, when the excess of water is liberated in the condition of a mist or fog, very light, of course, and millions of these atoms of water become direct reflectors at as many million angles. To convey an approximate idea of the intensity and brilliancy of the light it will, perhaps, be sufficient for me to say that the smallest type used in your publication is as clear at a point 3,000 feet from the looking-glass as in the open sunlight, and every item in your paper can be read at any point in the tunnel as rapidly and with as much ease as if out of doors.

It may be that some unfortunate may derive a benefit from having the use of this light suggested to him. If it will save one individual from being burned, as I have been, or as I have seen a number of my workmen, I shall be fully compensated for the time spent in preparing this communication, and you will be entitled to the thanks of the mining profession everywhere for publication.

The light may be used for many purposes underground, and many times diverted from the first mirror line.

JNO. W. C. MAXWELL.

New Idria, California, February 20, 1880.

A Fatal Italian Disease.

An Italian correspondent of the *Lancet* calls attention to an insidious and frightfully fatal disease called "pellaga," of which no less than 97,000 Italians are said to be dying, at the present time, the number of victims representing 3.62 per 1,000 of the whole population, and in the infected departments, especially in Lombardy and Venice, a higher proportion than ever occurred during the worst cholera epidemic in France. The disease usually runs a slow course, like consumption. Its cause is believed to be the exclusive consumption of maize in a deteriorated condition and the unhealthy state of the hovels in which the rustics live.

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THE NEW LECLANCHE BATTERY.

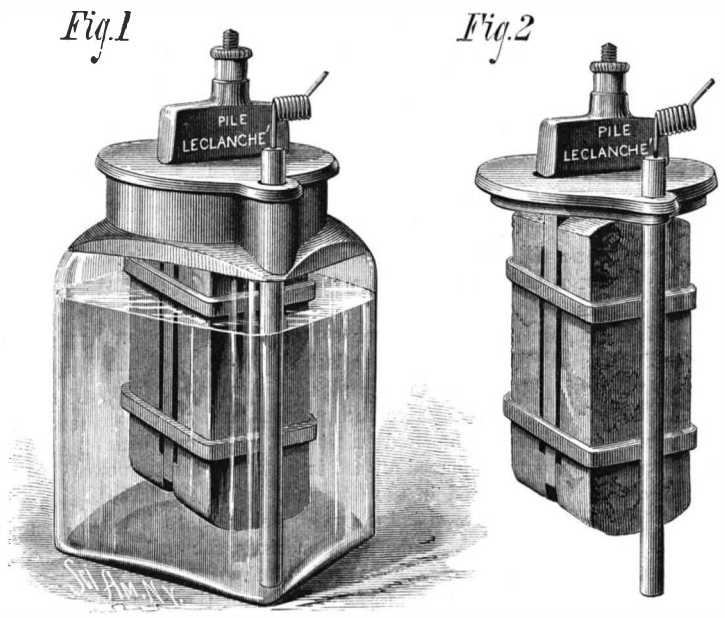
The Leclanché battery is now more generally used for open circuit lines than any other, and its peculiar adaptability to the telephone service has given it an immense field of application. In the battery shown in the annexed engraving the porous cup used in the ordinary Leclanché element is dispensed with, and a pair of compressed prisms, containing all the materials formerly used in the porous cup, are substituted for it. These prisms are placed upon opposite sides of the carbon plate, and are kept in place by rubber bands.

The negative pole consists of a pencil of amalgamated zinc, and the two poles are suspended from the cover in a solution of sal ammoniac and water.

The zinc being indefinitely preserved in the sal ammoniac solution, and the peroxide of manganese being insoluble in the solution, no action can take place when the battery is not in use.

After thorough tests by the various telephone companies, this battery has been universally acknowledged to be better than any other for telephone purposes, as all of its parts are visible, and any derangement may be at once discovered. The battery is readily taken apart, cleaned, and set up again. To do this requires no special knowledge of electrical apparatus. When the elements become exhausted from long service, they may be renewed by taking off the prisms, soaking the carbon below the head in hot water, attaching new prisms, and setting it up with a new zinc and a fresh sal ammoniac solution.

Further information will be furnished by the Leclanché Battery Company, 40 West Eighteenth street, New York.



THE LECLANCHE PRISM BATTERY.

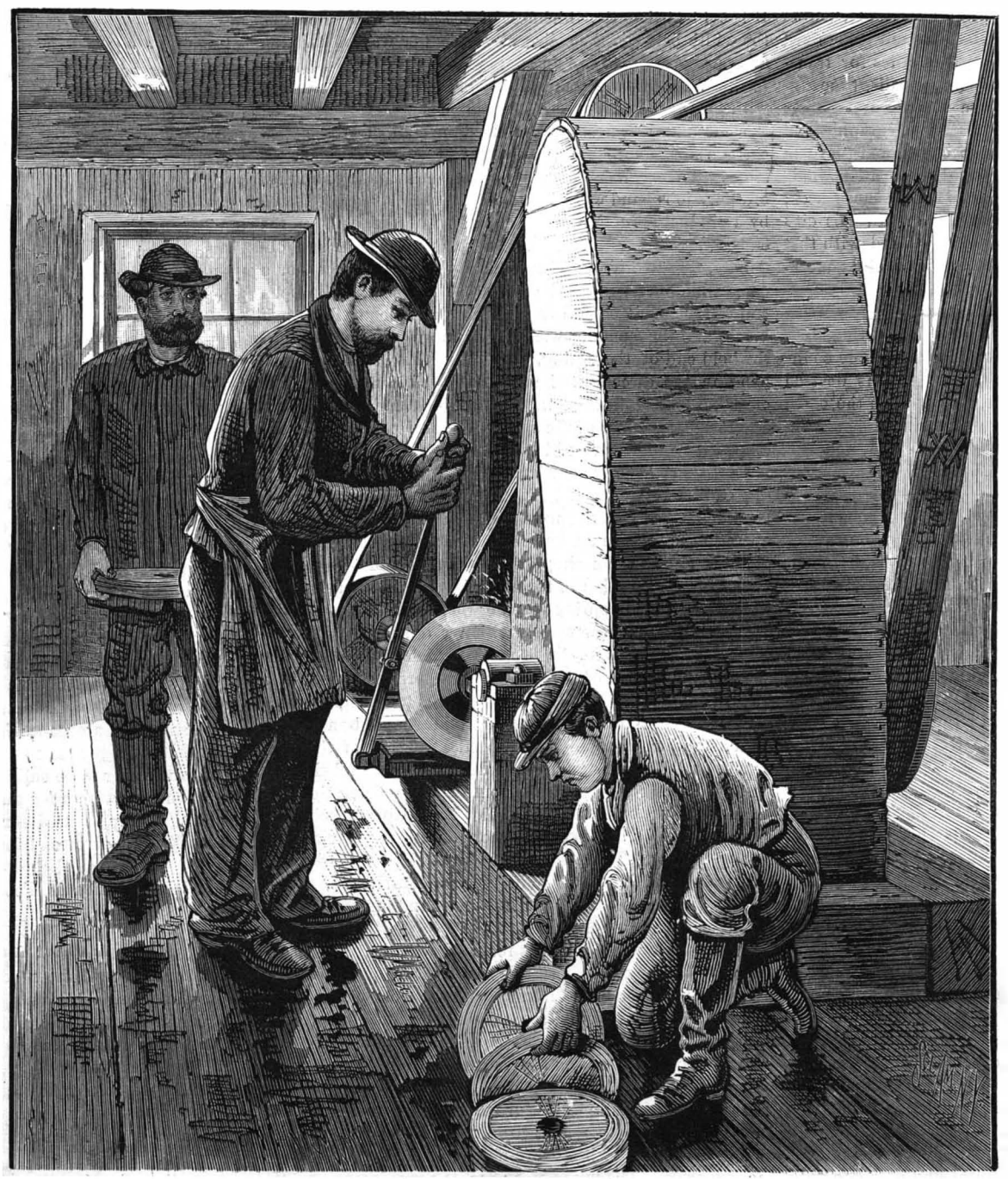
STEEL IN AGRICULTURAL TOOLS.

Steel is rapidly taking the place of cast and wrought iron in the manufacture of agricultural implements, and being much stronger than iron, it admits of making the tools not only a great deal lighter, but stronger, and better calculated to resist wear. Our sketch, which we take from one of the departments of the Anderson Steel Works of Pittsburg, Pa., represents one of the processes in the manufacture of rotary colters for plows. The workman has mounted upon the end of a rotating shaft, a disk of tempered steel, which, as it revolves, is pressed forward against the periphery of a huge grindstone revolving in the wooden casing and constantly supplied with water.

The face of the stone is divided into three steps or sections of different diameters, one section being used for roughing the disk, another for shaping it, while the third is reserved for finishing. As the disk is pressed against the stone, the shaft that supports it is oscillated by means of the vertical lever held by its workman. This movement gives the disk its lenticular form.

Messrs. Anderson & Co. make a composite sheet for agricultural tools and other purposes, consisting of an iron central portion faced on both sides with steel. The method of making this article is extremely simple. The mould into which the steel is poured contains a thick plate of iron, which divides it equally and forms the central iron portion of the composite ingot which is afterward rolled into sheets. As the hot steel is poured into the mould it is perfectly welded to the sides of the iron plate.

THE opinion of travelers that there is no danger in bathing in the Dead Sea, because one cannot sink in its heavy waters, has met with a rude shock. A lady's maid ventured out beyond her depth, and floated face down. She was turned over and brought ashore with great difficulty, after having swallowed enough of the acrid water to make her dangerously sick.



GRINDING ROTARY COLTERS.

The Largest Haddock Fare Ever Landed.

The schooner Martha C., Captain Charles Martin, arrived at Boston recently with a fare of 72,000 lb. haddock, the largest amount ever landed on a single trip, which sold at $25 per 1,000 lb., giving her a stock of $1,803. She was absent seven days, and engaged in fishing two days. The expenses of the trip were $137, and the crew of fourteen men shared $76 each. The largest fare before reported was 70,380 lb., taken on Georges, in 1878, by schooner E. L. Rowe, Captain Sewell W. Smith, on a five days' trip. The largest fare ever taken in one day's fishing was 54,200 lb. by schooner Paul Revere, Captain John Bentley, in 1877.—*Cape Ann Advertiser.*

ACID PROOF CEMENT.—Make a concentrated solution of silicate of soda, and form a paste with powdered glass. This simple mixture will sometimes be found invaluable in the operations of the laboratory where a luting is required to resist the action of acid fumes.

Then and Now.

Owing partly to the improvement in tools and shop appliances, and partly to the system of subdivision of labor, there is no parallel by which the workman of to-day can be gauged or compared with the workmen of thirty or forty years ago. Then the apprentice was taught—crudely, perhaps, but still taught—all the mysteries of his calling, from the preparation of the crude material to the finish of the completed result. The carpenter hewed his timber from the tree trunk or limb by means of chalk line and broadax. He bored, and mortised, and cut tenons, erected the frame of the building, boarded and shingled, and clapboarded and lathed. The blacksmith shod horses and oxen, tired wheels, made bolts and nuts, chipped and filed and drilled, forged and tempered axes and chisels, and performed numberless jobs of a variety of forms and for a variety of purposes. The machinist sometimes made his own patterns and often his own tools, worked at the vise and the planer, the lathe and the forge, and was ready to undertake any job, from repairing a broken stove to building an engine.

Our venerable contemporary, the Boston *Journal of Commerce*, remembers when the above practice was universal. We congratulate it on surviving to see all this changed. Now timber is sawed and not hewed; mortises and tenons are machine cut; houses are built by the shinglers, the lathers, and the joiners, as well as by the carpenters: and the doors, windows, window and door frames and sashes are factory built. The horseshoer does nothing else. The forger of steel seldom works iron. The tool maker is nothing but a tool maker. The machinist is a bench man, a lathe man, a planer, a fitter, or he has a specialty in cotton machinery or woolen, or never works but on steam machinery.

It cannot be expected that the man who has worked only in a certain department will be entirely at home in others; but, on the other hand, he who has worked at all branches will not be likely to be an expert in any one branch. In versatility and in contriving makeshifts, he who learned his trade when the arts were young, and performed a portion of all the work, is better than the specialist; he may be an invaluable man in a crisis. But the lather can prepare a room for the plasterer with much greater rapidity and in better shape than the carpenter who turns from making a door to lathing a room. The tool forger can temper steel better than the blacksmith who turns from the forging of a mill crank to the tempering of a turning tool. The machinist who has worked for years on steam engines can sooner put a disabled engine to work than one who learned his trade at building cotton machinery. In the one case, the man is an expert; in the other, simply a workman.

Meteoric Iron in Snow.

Observations of snow collected on mountain tops, and within the Arctic circle, far beyond the influence of factories and smoke, confirm the supposition that minute particles of iron float in the atmosphere, and in time fall to the earth. By some men of science, these floating particles of iron are believed to bear some relation to the phenomena of the aurora. Gronemann, of Göttingen, for instance, holds that streams of the particles revolve around the sun, and that, when passing the earth, they are attracted to the poles, thence stretching forth as long filaments into space; but, as they travel with planetary velocity, they become ignited in the earth's atmosphere, and in this way produce the well known luminous appearance characterizing auroral phenomena.

Professor Nordenskjöld, who examined snow in the far north, beyond Spitzbergen, says that he found in it exceedingly minute particles of metallic iron, phosphorus, and cobalt.

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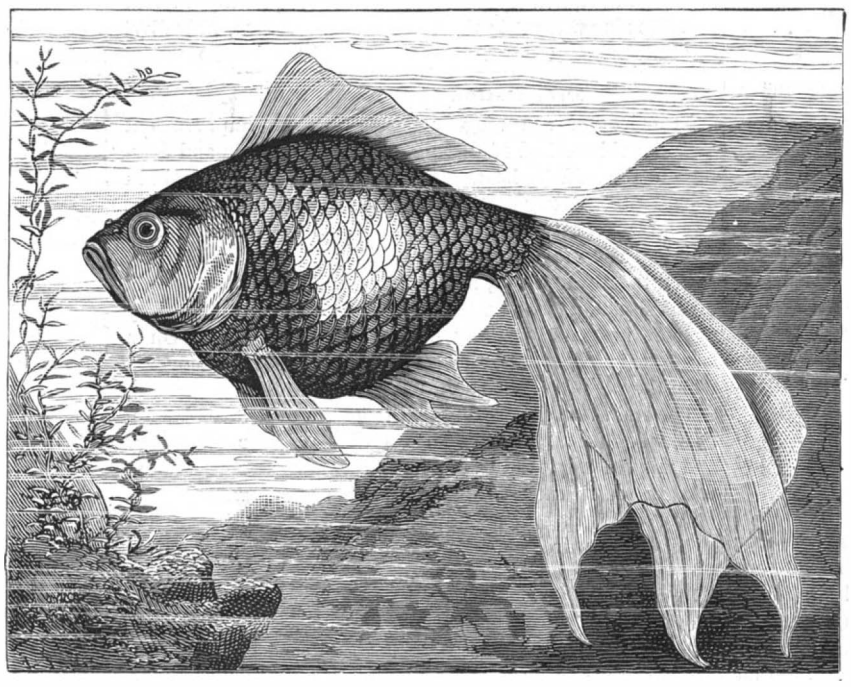
THE KINGIO AND THE TONG-TSING-YO.

The kingio, one of the most beautiful varieties of the golden carp probably ever bred, was imported from Japan by Mr. Gill, of Baltimore, a few years ago. After much persuasion and an offer of $500, one of the most beautiful of the few that reached this country alive was secured for the aquarium.

Too much can hardly be said of the wonderful beauty and grace of this fish. Its sides were resplendent with delicate pearly and golden tints, which, as it moved through the water with great dignity, are constantly changed in degrees of color under the various angles of light. It is said that this single specimen yielded to the establishment not less than $3,000 profit. Had it been fed on vegetable food instead of animal (raw liver) it might still be alive. The caudal and anal fins of this fish were united, and were of a pearly white color and of a delicate texture, which, as the kingio passed through the water, floated gracefully behind the fish as if composed of some delicate fabric. Several attempts have been made to establish this variety in this country, but all the specimens I have seen thus far seem to have gone back to the original starting point, which undoubtedly is the golden carp or our common gold fish.

The tong-tsing-yo, or telescopic-eyed fish (also known as the dragon-eyed fish), is a native of China. A few specimens of it were imported to this country a few years ago. This, like the kingio, is undoubtedly another monstrosity of the golden carp, and a very remarkable one, which has been established by continuous selection by the Chinese with the wonderful art they display in breeding these domesticated pets, until the progeny is so disguised that the original form is almost lost. Viewed from the front this fish has a large, broad forehead and great projecting eyes. With this fish the caudal and anal are united, but spread out from the fish, as shown in the illustration.



THE KINGIO.

The Durability of Gutta Percha.

In his lectures before the Society of Arts on the recent advances in telegraphy, Mr. W. H. Preece, the electrician to the British Post Office Department, pointed out some of the curious accidents to which gutta percha covered wires were liable: "Gutta-percha covered wires," he said, "would be very well if they would last. But, unfortunately, gutta percha is a gum that only appears to last when in water. In water it apparently is indestructible. Cables that were laid in 1851, and have been brought up within a recent date, are now as good as the day when first put down. But when gutta percha becomes exposed to the air, to the alternations of climate, especially when exposed to the action of the sun, it decays very rapidly; it oxidizes, and becomes a kind of resin that can easily be crumbled into a snuff-like substance. Many attempts have been made to protect it and to arrest this rapid decay. It has been surrounded by tape soaked with tar. Tar itself has been found to be injurious, and has been supplanted by other materials, but at the present moment we have not yet succeeded in finding anything that renders gutta-percha indestructible. In fact, when exposed to air, as when suspended in tunnels, it seems to have a life of about ten years; when laid down in our iron pipes, under the influence of the variations of temperature and moisture that exist there, it seems to last about twenty years; but in the sea, where it is exposed to equable temperature and equal condition, it apparently seems capable of lasting forever. There are many curious accidents and causes of interruption to working that we meet with in our gutta-percha covered wires, and one of the strangest is one of the last that we have discovered. We have found in many places that this gutta-percha is apparently gradually eaten away. It seems to go not unlike the way in which open air wires rust away; and this curious action only occurs in certain places. In certain parts of the country, North Wales, Dublin, Kent, and in one part and another, we have found this curious action going on; and careful examination and inspection under the microscope have led us unmistakably to conclude that it is due to something or other eating away the gutta percha. Curiously enough, wherever we have detected this action taking place, there, also, we have found swarms of a very minute insect, a very little thing, belonging to what is called the spring-tail tribe. It is a little white fellow that you can scarcely see, and when you do see him he seems conscious of the fact, for he immediately disappears with a spring. It is the *Templetonia crystallina*. It abounds in swarms in certain soils, and seems to have a great liking for gutta percha. It does not remain near the wire when it has eaten its way through, but, apparently, immediately retires when it touches the wire, as though it had received a shock, and makes a sudden retreat. It is a curious fact, and until recently it was unknown, that any living creature had a taste for gutta percha."

An Alligator Survives Freezing.

The ability of many of the lower forms of animal life to survive freezing is well known. Even those so high in the scale as fish—cat-fish, for example—may be frozen stiff and kept for days in that state, yet "come to life" when slowly thawed. The first instance of the revival, after freezing, of an animal as high in the scale as an alligator is reported in this city. During a recent cold snap the window of a room, in which was kept a Florida alligator, was left open, and the water in which the reptile lay was frozen. The owner of the animal, a young physician, found his pet "as stiff as a poker," and to all appearances dead. It was placed in warm water, rubbed with alcohol, then wrapped in a cloth and left by a stove to warm up. After an hour or two it was rubbed again and dosed with liquor, its mouth having been pried open. This vigorous treatment was kept up for a couple of hours, when signs of life appeared, and in a few hours more the alligator had entirely recovered.

Foreign Bodies in the Ear.

At a recent meeting of the New York Clinical Society, Dr. G. H. Fox mentioned the case of a patient who for several days had had pain in the ear, with impaired hearing. A wad of soft paper was found firmly impacted in the ear, and was removed. The man had taken a surf bath a few days before, and had first felt the pain and deafness immediately after having been struck on the side of the head by a wave. The only way that he could account for the presence of the paper in his ear was that it had been carried in by the wave.

Dr. A. A. Smith alluded to the case of a lady who had engaged him to attend her in labor, and who complained of headache, dizziness, and nausea, without any evidence of kidney trouble. She soon found that she was somewhat deaf, and Dr. Smith discovered and removed from her ear a wad of cotton half an inch long, which had been inserted five months before. Her symptoms at once disappeared.

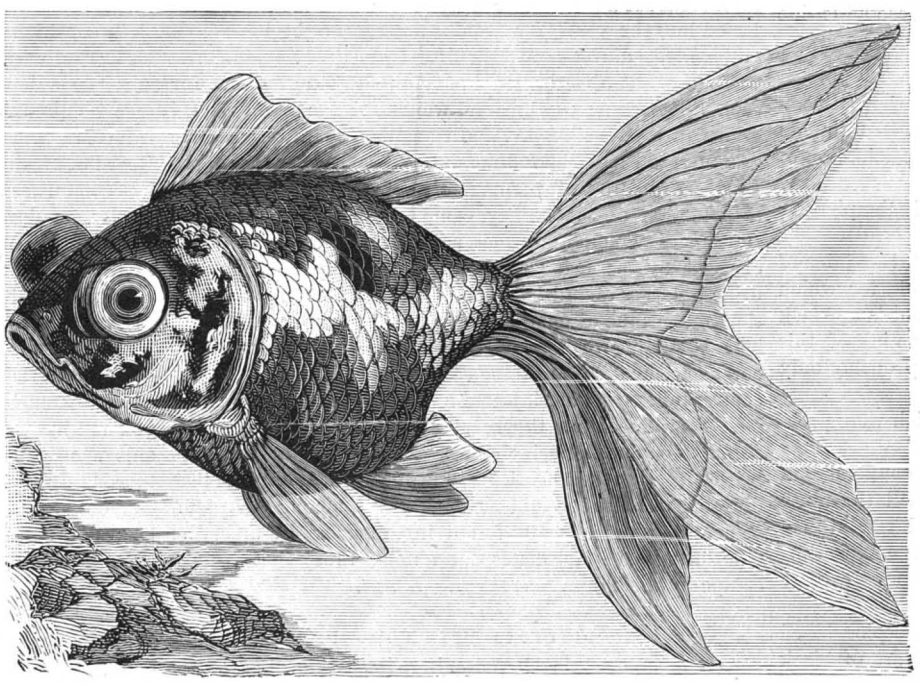
Terrapin.

In a letter to the *Republic*, of Washington, "G. H. B." tells what he knows about terrapin. The following facts are of general interest:

It is in Lent that terrapin commands its highest prices. They are worth from $25 to $36 a dozen during the season. A dozen terrapins consist of twelve diamond-backs, no one of which must be less than a "count terrapin," that is, measure seven inches in length on the under shell. The largest known do not exceed ten inches in length and eight pounds in weight, and such prizes are extremely rare. The seven inch terrapin averages four pounds in weight. "Sliders," the common river turtles of almost all the rivers of the South, grow to a much larger size. They bring from $6 to $9 a dozen.

The two or three men who control the trade in Baltimore say that they sell almost exclusively for private tables. Terrapin are caught all the way from Savannah and Charleston to the Patapsco and Gunpowder rivers—scarce here—but the genuine diamond-back belongs almost exclusively to the upper Chesapeake and its tributaries. The majority of the sliders come to Baltimore from the James river and streams adjoining. An active terrapin catcher sometimes makes $50 a week, but the find varies, and often runs down as low as $5. The reptile is discovered by probing the mud in the shallows with a stick. He is dormant and easily captured.

The females are more highly prized, and are known as "cow" terrapin. They generally contain about thirty eggs, some of which you have a right to expect to garnish the dish at $1.25 a plate. I am not betraying confidence in stating that may restaurateurs, reckless of their fair fame, have resort to the eggs of the pigeon made into a paste and rolled into a substitute for the genuine article. Thirty years ago the largest dealer in Baltimore found it difficult to dispose of the terrapin he received at $6 a dozen. The product, he says, is about the same year in and year out. He sells as many now as he did then. The negroes who bring them to market say that they are growing yearly scarcer, and nothing but the high price stimulates them to keep up the supply by a more extended and persistent search. The Commissioners of Fisheries of this State, in their report of 1876, deplore "the much diminished and rapidly diminishing supply of this most excellent luxury of the Chesapeake Bay," and suggest its increase by cultivation. They add: "There are hundreds of localities admirably situated in our terrapin-producing regions which could be made more productive, acre for acre, than the best surrounding land, by the establishment of terrapin ponds."



TONG-TSING-YO.

Importance of Fish Culture.

As the *American Ship* pertinently remarks, Hon. Levi P. Morton has done a good service in calling attention anew to the importance of farming our streams, lakes, and ponds, as well as the sea, that the water as well as the land be made to contribute to the food supply of our constantly increasing population. Norway leads the world in her fisheries, with an annual production valued at $13,600,000, and yet we have opportunities for expanding to a limit even surpassing these enormous figures. The artificial propagation of fish has been attended with encouraging results, first in Germany, then in France, and latterly in the United States, having become one of our most important industries. The United States Fish Commissioners say: "Norway is the only European nation that has a scientific commission occupied officially in the supervision of the fisheries and in devising methods by which they may be carried on and extended with the least possible waste. To the labors and observation of such men as Dr. Boeck, Professor Sars, and others, is due much of the present efficiency of the Norwegian fisheries." In 1867 we imported about as much fish as we exported. If we devoted sufficient energy to the business we could export one hundred times as much, and need import none at all. Fish culture is in its infancy. Its resources are immeasurable. It may approximate and even rival agriculture in importance. Its development will give employment to large numbers of men and bring food within the means of the poor as well as of the rich. The propriety and utility of international exhibitions, like that now in contemplation at Berlin, where the representatives of our nation can learn the nature of the products of the others, as well as show its own in a universal market, can no longer be questioned.

CEMENT FOR REPAIRING GLASS.—Dissolve fine glue in strong acetic acid to form a thin paste.

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Colors and Dyes Used in Antiquity.

BY MARIUS MOYRET.

In the realms of literature and the fine arts the perfection of the ancients is willingly admitted. But in industrial matters they are either depreciated to an exaggerated extent or exalted beyond measure. We will endeavor to prove that both these opinions are at fault, at least in so far as colors are concerned, building simply upon positive facts, and strictly rejecting all hypothesis or random conjecture.

We will examine in succession the various colors known to the ancients, and compare them with our modern colors.

Whites.

Chalk and white lead were the only white colors known of old. But under the name of chalk they confounded true chalk (carbonate of lime) with various argillaceous earths, such as pipe clay. As for the white lead of the ancients, it is known only from the accounts of its preparation given us by Theophrastus and Dioscorides. According to Pliny, the white lead manufactured at Rhodes was superior to all others.

Davy, who has analyzed a great number of ancient colors, did not find white lead in any of the specimens submitted to his examination.

To the whites known by the ancients there have been added in modern times:

1. Pearl white, or subnitrate of bismuth, the use of which is of very little importance (being rarely employed save for the reprehensible purpose of powdering the face, a custom which is unfortunately no longer confined to women of questionable character).

2. Zinc white, a color preferable to white lead in a great number of cases, in so far as it is less poisonous and is not affected by sulphur fumes.

3. Permanent white or *blanc fixe* (artificial sulphate of baryta). This color is absolutely fast, not poisonous (being neither volatile nor soluble under any probable circumstances), and very much cheaper than white lead. It is largely consumed in the production of paper hangings.

Dyeing white was unknown in antiquity. The natural whiteness of linen after being bleached on the grass—that of the wool of white sheep, after the action of burnt sulphur, which appears to have been known and practiced in very remote ages—and the white silks of China, were all that could be produced in the way of white goods.

To many persons, even in our days, the word "dye," as applied to whites, seems nonsense. Pure white does not exist.

Both vegetable fibers after being bleached with chlorine, and animal fibers after stoving, retain a yellow or grayish cast, which has to be combated by the addition of a color *complementary* to yellow. This is the meaning of dyeing whites, an operation which must be pronounced modern. Sometimes we go further than merely destroying the yellow tint, and give a slight color. White, therefore, now ranks truly among the very light shades, and takes various names according to its tint. Thus we have azure whites, inclining to a blue; cream whites, tending to a yellow, etc.

For a long time indigo and annatto have been exclusively used in white dyeing; then came extract of indigo and ammoniacal cochineal, which have in their turn been laid aside in favor of the aniline colors.

Blacks.

The ancients knew the several varieties of carbon still employed as black colors. The painter Apelles, according to Pliny, made use of the black obtained by the calcination of ivory.

Davy detected lampblack mixed with ochers in the pictures of the baths of Livia.

For writing ink the Romans employed, first, the juice of mulberries, then a kind of imperfect Indian ink, for which Dioscorides has given the receipt: three parts of lamp black with one part of gum. It is probable that an ink of this kind was in use among the Greeks. It was probably only semi-fluid, and required to be ground up.

The ancients used various colored inks, which were probably pigments suspended in water.

They dyed leather black with gall nuts and copperas, but this preparation was not employed as an ink till the ninth century of the Christian era. It is, moreover, less solid than the inks with a base of lampblack. If the manuscripts found at Herculaneum had been written with our ordinary ink they could never have been deciphered.

We have made no additions to the list of black colors based on carbon, but we have greatly improved the art of black dyeing.

Black, in the strictest sense, does not exist. It is merely relative, and appears black only when seen alone. But if we place two different blacks in contact they each take a different tint by the force of contrast. The art of the modern black dyer consists in obtaining these shades at will, a matter which the ancients appear to have overlooked.—*Teinturier Pratique—Chemical Review.*

Zinc Powder.

Zinc powder having now a practical utility in the treatment of color, etc., a method for ascertaining its quality becomes essential.

If zinc powder is brought in contact with sulphuric acid and bichromate of potash, using more than double the quantity of the last theoretically needful, there is no escape of hydrogen, but the hydrogen in the nascent state reduces the chromic acid to chromic oxide.

To one gramme of the zinc powder add 100 cubic centimeters of a solution of pure melted bichromate of potash (say 40 grammes per liter), and stirring diligently, add twice, each time, 10 cubic centimeters of dilute sulphuric acid, and allow it to act for a quarter of an hour. When the zinc powder is completely dissolved, save a small residue which always remains, an excess of sulphuric acid is added, and 50 cubic centimeters of a strong acid solution of sulphate of iron (say 200 grammes per liter), whose value with respect to the solution of the chrome has been already determined. A slight excess of the latter is then cautiously added, and titrated back with the acid solution of chrome till a drop of the liquid is no longer colored blue by red prussiate. The quantity of the bichromate of potash consumed, multiplied by 0·66113, gives the quantity of real metallic zinc present in the sample.—*V. Dreusen, Zeitschrift für Analytische Chemie.*

Preparation of Benzoic Acid.

Prof. Rudolf von Wagner has devised an improvement over the old method of distilling the gum benzoin and driving out the acid by heat. He dissolves the benzoin resin in 3 or 4 pints strong acetic acid, decants the brown solution, and adds 4 parts boiling water. The resin separates upon dilution as a gray-brown mass, and is removed by filtering. When the filtrate cools, a large portion of the benzoic acid crystallizes out, while a second portion may be obtained by evaporating and partially neutralizing with lime. On a large scale, of course, the acetic acid could be recovered from the acetate of lime solution.

The resin that is precipitated from the acetic acid solution, when dried and fused, has a pleasant odor of storax, and may be employed to impart a pleasant odor to sealing wax, or for making fumigating pastilles and powder.

The solubility of benzoin resin in acetic acid should give it other uses in perfumery, as in disinfecting smoking essences. Tolu and Peru balsams and storax are also soluble in acetic acid.

Glucose from Rags.

The *Revue Industrielle* states that a German manufactory is turning out over a ton a day of glucose made from old linen rags. These rags, which are composed of hard vegetable fibers, are treated with sulphuric acid, which converts them into dextrine. The latter product thus obtained undergoes a washing with milk of lime, and is then treated with a fresh supply of acid stronger than the former, when the mass is at once transformed and crystallizes into glucose, of which "rich" confections and jellies may be made. The process is said to be a very cheap one, and the glucose chemically identical with grape sugar.

A strong outcry, however, has arisen against the manufacture of grape sugar from rags, and the enterprise is understood to be in danger of being interfered with by the German Government.

Action of Salts on the Kidneys.

MM. Richet and Moutard-Martin have continued their researches on the effects of injecting various substances into the veins, and have communicated their results to the Académie des Sciences. They find that distilled water injected into the veins, far from being, as might have been anticipated, diuretic, arrests the ordinary secretion, even when the quantity thrown in amounts to ten grammes for each kilogramme of the total weight of the animal (1,544 grains to each 2·2 lb. av.). In smaller quantities, as five grammes to each kilogramme, it checks without arresting it. In larger quantities it permanently arrests the secretion, and the function of the kidney cannot be re-established. All substances which are either normally or accidentally discharged by the urine are diuretics, if they occur in the urine in larger quantities than natural; in fact their elimination induces the discharge of a certain quantity of water. The beginning of the diuresis coincides exactly with the commencement of the elimination. The condition of concentration of the fluid injected appears to matter little in the effects produced on the renal secretion, for the polyuria seems to be due exclusively to the elimination of the salts injected. In a therapeutical point of view it is obvious that diuretic remedies should be looked for among the substances that are normally found in the urine, as urea, the chlorides, and phosphates, or among those that readily escape by the kidneys, as sugar.—*Lancet.*

Iodide of Starch in Poisoning.

As a general antidote in poisoning, Dr. Bellini, in a paper read before the Medical Society of Florence, Italy, recommends iodide of starch. It is free from any disagreeable taste, and does not possess the irritating properties of iodine, so that it can be administered in large doses. He has made numerous experiments, and states as a result of these, that at the temperature of the stomach and in the presence of the gastric juice the iodide combines with many of the poisons, forming in some cases insoluble compounds, in others soluble compounds, which are harmless, so long as they do not exist in too large quantities. He recommends it as safe in all cases where the nature of the poison is unknown, and as especially efficient in cases of poisoning by the alkaloids and alkaline sulphides, by ammonia, and especially by those alkaloids with which iodine forms insoluble compounds. In cases of poisoning by salts of lead and mercury, it aids the elimination of these compounds. In cases of acute poisoning, an emetic should be employed soon after the administration.

Vaccination and Smallpox.

At a late public meeting in London, under the auspices of the National Health Society, Mr. Ernest Hart delivered an important address on the relations of vaccination to public health. Dr. Andrew Clarke presided, and, according to the London *Times'* report, in introducing the speaker he remarked that ever since the introduction of vaccination there had been two opinions on the subject. One party had held that it was an almost unmixed good to mankind—that it had checked the ravages of a loathsome disease, and that the dangers of this disease had been so lessened that its fatality was almost banished in those who were vaccinated. On the other hand, the opponents of vaccination held that it was an almost unmixed evil—that it had neither lessened the disease nor the mortality from smallpox; that it had introduced other and great diseases into the human frame; and that for those who practiced it hanging was too good. Now, into this conflict of opinion, somehow or other, there had been imported a passion which belonged to a strong conflict, and this passion had arisen, perhaps, from an inadequate view of the whole subject. With this passion raging on both sides, honest and simple folks outside were hardly able to judge of the side to which truth belonged. The question had now passed from the press and the platform to Parliament, and as legislation was likely to follow—legislation which would be of infinite good or infinite evil to the public—the National Health Society had had to find one of a calm and judicial mind who would lay the facts on both sides before the public.

Mr. Hart commenced his lecture by stating that, having been asked for information with regard to the statements of the anti-vaccinators, he had been able to refer his inquirers to the standard works on the subject and to statistics of the Registrar-General; but what seemed to be wanted was some plain, practical, and direct answer to the specific allegations of the anti-vaccinators. He set himself to prepare such a statement, and in reading the statements of anti-vaccinators he was astonished to find their literature made up of surprising misstatements, misquotations, and absurd descriptions of physiological subjects, and those who imbibed knowledge from these statements—and, generally speaking, they were the classes least able to judge—were examples of the aphorism, "a little knowledge is a dangerous thing," and suffered much evil from these misleading facts.

Mr. Hart then went into a lengthy history of the ravages which smallpox had caused not only upon the British, but other peoples of the world, and he remarked that if the like mortality occurred in England now to that which was constant in the olden time, before the introduction of vaccination, the annual death rate from smallpox would be 70,000. Before the days of vaccination a third of all the deaths of children arose from smallpox, and all classes suffered from it. This was instanced from the fact that King William III. had his constitution broken from it; and lost, besides other members of his family, his wife, mother, and father from the loathsome disease. The speaker quoted Macaulay's words lamenting that, while the plague had visited the country twice, the smallpox was constantly in our midst in olden time, cutting off vast numbers of our people, and even when it spared the life of a child it made it a changeling, at the sight of which the mother shuddered.

He then went minutely into each of the allegations of the anti-vaccinators and showed their fallacy, strengthening his case by quotations from the Registrar-General's statistics, from Mr. Simon's letter to the President of the General Board of Health, and from the evidence taken before the select committee of the House of Commons in 1871. In particular, he devoted much time to the allegations that vaccinations had not diminished the mortality from smallpox, that it did not ward off an attack of smallpox in the individual, and that it caused increased mortality from other diseases. He brought forward copious statistics to show the inaccuracy of these allegations, and showed, on the contrary, from the accumulated facts of the last eighty years, how large an influence vaccination has in checking smallpox and in modifying its course in those vaccinated individuals who caught it. He gave figures to show that a thoroughly vaccinated person has only one-seventieth of the chances of catching smallpox that an unvaccinated person has; and that if he be attacked by the disease he has fifty times as many chances of recovery as a person unvaccinated. He explained the inaccuracy of the idea that vaccination inoculated other diseases, and pointed out that, as regards syphilis, the danger was infinitesimal, while, on the other hand, there was the enormous assured advantage in vaccination of prevention of mortality from smallpox. Mr. Hart insisted strongly on the necessity of vaccination being thoroughly performed, and of revaccination at puberty, and he made certain suggestions designed with a view to make vaccination more general and thorough. He summed up the evidence in favor of vaccination, which he described as overwhelming.

ORANGES AND LEMONS.—It is stated that the Mediterranean supply will be very limited this year, orange and lemon trees bringing forth, quite as olive trees, a full crop but every two years. Besides, the small crop has itself been seriously damaged by frost, so that complaints are general in Sicily, Naples, and on the Adriatic coast.

TO REMOVE INK STAINS.—Take of muriate of tin, 2 parts; water, 4 parts. To be applied with a soft brush, after which the paper must be passed through cold water.

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The Canal.

The House Committee on the Interoceanic Canal lately had before it Mr. Menocal, Civil Engineer, United States Navy, who has made several surveys on the isthmus, and heard his statement as to the relative advantages and disadvantages of the Nicaragua and Panama routes. Mr. Menocal strongly favored the Nicaragua route as being 660 miles shorter than the Panama route between San Francisco and New York, and because of the greater salubrity of its climate, the better supply of building material, and its relative cheapness of construction. He expressed his conviction that the cost of the Nicaragua canal would not exceed $70,000,000, while that of a sea-level canal *via* the Panama route would probably be $400,000,000. The latter he considered as commercially impracticable. He admitted that the Nicaragua route would consume more time on account of its greater length and locks, and that the annual expense of maintaining it would be probably twice as great, but that these features were compensated by its lesser cost.

The Committee also had before it Commodore E. P. Lull and Lieut. Frederick Collins, United States Navy, who entertained the Committee, so says *Engineering News*, with very interesting arguments in favor of the Nicaragua canal route.

Lieut. Collins has been associated with nearly every isthmus survey that has been made in the past ten years. He was not, however, connected with the survey of the Panama route made in 1875 under Commander Lull.

Lieut. Collins has made a study of the wind and water currents of the Pacific coast in the vicinity of Panama, and exhibited a chart to illustrate his paper. The belt of calms, some 1,200 miles wide, reach from the coast of Panama westward. A strong current of northwest winds blow down the Pacific coast from San Francisco the greater part of the year, their width from the coast diminishing as they approach Panama. A similar wind comes up along the South American coast, reaching some 500 or 600 miles from the coast. These currents seem to rise on meeting and ride over the belt of calms. They, however, produce a disturbance of the calms belt near the coast of Panama that is well known as an area of vexatious squalls, calms, and delays. Sailing vessels leaving Panama for San Francisco take a course south, trending along the South American coast to 10° south latitude, and then southwest and west from 600 to 800 miles west of Panama before finding a wind to help them northward, and make the trip to San Francisco in 36 to 40 days. Vessels leaving the coast of Nicaragua, say at Brito, following the course projected by himself, would be north of the calms belt, and standing westward would get outside of the down coast currents of both wind and water, and be able to reach San Francisco in 23 to 26 days, on a course of 3,240 miles, while the sailing course from Panama to San Francisco is some 5,350 miles, although Panama is only some 500 miles south of Nicaragua, or Brito; so that the wind and air currents of the Pacific Ocean near the coast of Panama and its isthmus give the Nicaraguan canal route an advantage of some thirteen to fourteen days over a route *via* Panama.

THE NICARAGUA ROUTE.

Commander Lull exhibited a map of Nicaragua, explanatory of Mr. Menocal's report of surveys. The old Nicaragua transit company, which ascended from the Atlantic *via* the San Juan, traversed Lakes Nicaragua and Managua, and thence to the Bay of Fonseca. Lake Managua being higher than Lake Nicaragua, additional locks would be required, and the stretch of country between Managua Lake and the Bay of Fonseca being almost entirely volcanic *débris* (ashes and sand), does not hold the water that falls, and wells from 100 to 300 feet deep are made to get water. This section of canal would need to be concreted to render it tight. This route would be about 300 miles long.

The surveys made by Messrs. Childs & Fay, in 1850–1, for the American Atlantic and Pacific Ship Canal Company, were *via* the San Juan river to the Lake Nicaragua, and directly across the lake and *via* Rios Lajas and Grande to Brito. Fourteen locks were to be used on each side of the lake.

The survey made by Mr. Menocal followed the same route up to and across the lake, but left the lake some miles north of the Rio Lajas route, with better results. This route leads into the bed or valley of the Rio Grande a torrent in the rainy season, which could scarcely be controlled. It is believed that thorough examination will show the practicability of turning the head of the Rio Lajas with Lake Nicaragua by a deep cut, and render the bed of the stream available for the site of the canal, which will very materially lessen its cost for this section.

The southwestern shore of the lake is of rock, and would require rock excavation under water to provide a proper depth of channel to reach the Pacific portion of the canal. The ridge to be cut through on the Pacific side is 130 feet high, and the cutting averages 54 feet for six miles.

After passing this cut, the excavation and embankments are equalized, as in railroad work. An artificial harbor will need to be provided at Brito, by excavating a basin in the swamp flats at the mouth of the river, and protecting it from the sea by a dike. The bed of the lake at the outlet into the San Juan at Fort San Carlos, is very shallow, but is composed of the volcanic sand and ashes that is brought into the lake during the rainy flood season, which gravitate toward the outlet. [The map shows several islands near the outlet of the lake.] A channel will need to be dredged for this approach to the head of the river for a distance of nine miles. It is believed that this channel will not be difficult to maintain, as the material is very tenacious.

The Rio San Juan has several rapids above the mouth of the San Carlos, which are to be passed by means of short stretches of independent canal, and the remainder of the river is to be improved by the slack water system. [The San Carlos enters at about half way from the lake to the sea.] That portion of the river below the mouth of the San Carlos is entirely destroyed for purposes of navigation by being partially filled up by the detritus brought down by the San Carlos and Serapaqui, which drain large areas to the southeast in Costa Rica. The San Carlos has been so flooded as to carry back water 40 (?) miles up the San Juan [quite up to the rapid near the outlet of the lake]. The first dam above the mouth of the San Carlos will arrest this backwater. On account of the silted condition of the bed of the San Juan below the mouth of San Carlos, an independent canal is necessary from the San Carlos to the sea. In some places the spurs to be pierced are very high—in one place about 180 feet high—but Mr. Menocal, who is consulting engineer to the government improvement of the San Juan, has been allowed to visit the locality since the surveys were made, and is confident that a much more favorable and cheaper line can be now laid, saving, probably, some seven miles. It is the intention to divert the Rio San Juan into its old bed (the Colorado), and thus relieve the harbor at its present mouth from the shoaling that is going on from the detritus brought down during the rainy season. This will insure a good harbor at San Juan.

Lake Nicaragua rises and falls because of the rainy season about six feet, the time of oscillation occupying some six months. The area of the lake is about 2,700 square miles, and the area drained into it is some 8,000 square miles.

In studying the region of the isthmus, time is an essential element to get at its meteorological and climatic conditions, and Messrs. De Lesseps and Dirks have not been long enough on the isthmus to form any just idea of the difficulties which will arise in the construction of a sea-level canal. The mouth of the Colorado river shoals very fast. Cattle were grazing where I once landed from twenty feet of water, and a canoe would now ground where, as navigation officer, I once sailed a vessel. There are three locks above the San Carlos and seven below. The passage of a ship or other vessel through a lock will occupy about thirty minutes.

AGRICULTURAL INVENTIONS.

Henry R. Burdge, of Cape Girardeau, Mo., has patented an improved sulky cultivator, so constructed as to loosen and mellow the soil and cut off the roots of grass and weeds without turning the soil over. It may be readily adjusted to work deeper or shallower in the ground, and will work at a uniform depth in uneven ground.

Mr. Gustaf Holcomb, of Stillwater, Minn., has patented an improved thrashing machine. This invention relates specifically to improvements in the grain and straw carrying mechanism of thrashing machines. It cannot be clearly described without engravings.

Mr. Thomas B. Ashford, of Clinton, N. C., has patented an improved grazing post for stock, which will prevent twisting of the halter, and which can be easily secured and adjusted. It consists in a balanced lever, to which the halter is attached, pivoted to the top of a post, provided with a screw at the lower end for screwing it into the earth, and braced by a number of hook bars, which are driven into the earth to give it greater rigidity.

Mr. Adam C. Hendricks, of Duffield Station, W. Va., has patented an improvement in fertilizer attachments for seed drills. It is adapted to operate independently, but will in general be made an attachment of a seed drill. The improvement pertains to a rotating flanged wheel for discharging the fertilizer, and an adjustable gate co-operating therewith, for regulating the quantity of fertilizer discharged.

An improved device for planting corn in perfect check row, so that the rows shall be straight each way, and at the same time distributing a limited amount of fertilizer to each hill as it is planted, has been patented by Mr. Henry F. Graetzel, of St. Joseph, Md.

Mr. Thomas Delaney, of Waterloo, N. Y., has patented an improved plant protector. The object of the invention is to provide an efficient device for preventing heavy rains from washing the soil from about the roots of plants, while it gives the water free access to the plants, and also permits the air to circulate about them.

Faber's Talking Machine.

A great many years ago a talking machine, the invention of one Herr Faber, was exhibited in New York, and an engraving of it was published in the columns of this paper, as, no doubt, some of our oldest readers remember. We are reminded of that famous machine by an account in our English contemporaries of an improved talking machine exhibited by the successors of the original Faber before the Physical Society, and privately, for closer examination of its novel mechanism, to several well known scientific gentlemen.

This machine is said to be the product of the continuous labor and study of two members of the same family. It was begun in 1815 by Joseph Faber, and so far elaborated in 1841 that it was exhibited in that year to the King of Bavaria.

On the death of the original inventor, he bequeathed the machine to his nephew, the present owner, also named Joseph Faber, who had been associated with him in its construction, and who, report says, has greatly increased its power of articulation.

The Coming Comet.

In a letter to the Boston *Advertiser*, Professor Benjamin Peirce, of Cambridge, says that he is fully persuaded that the comet recently discovered by our eminent American astronomer (Dr. Gould in South America) is a return of the wonderful comet of 1843, which has been considered as in many respects "the most interesting of any on record" (Cooper's Cometic Orbits). The first record of this comet is in 1770 before Christ, with an average period of about seven years. The subsequent visible and recorded returns are, 370 before Christ, 252 and 183 before Christ, and after Christ 336, 422, 533, 582, 708, 729, 882, 1077, 1106, 1208, 1313, 1362, 1382, 1402, 1454, 1491, 1511, 1528, 1668, 1689, 1702, 1843, and 1880."

The appearance of this comet in 1843 is thus described by Professor Peirce:

"About noon on the 28th of February, 1843, groups of people in many of the towns of New England, especially in Portland, Maine, collected at the corners of the streets, gazing up toward the sun. Protecting their eyes in the shadows of the houses, they saw a brilliant object close to the sun. Such a marvelous spectacle had never before been seen. A thoughtful sea captain, Mr. Clarke, brought out his sextant, and repeatedly measured the distance of the strange object from the limb of the sun. These unique observations are on record, and, submitted to rigid criticism, attest the accuracy of the observer. In about a week from this time a wonderfully brilliant tail of a comet was seen skirting the horizon soon after sunset, and reaching more than one-third of the way round the sky. It was now a tail without a head, as it was at first head without tail; but they were members of the same comet. The best determination of its path was accomplished by the distinguished astronomer, Sears O. Walker. At its perihelion it passed nearer the sun than any known comet, with the single exception of that of 1680, computed by Sir Isaac Newton, and in the discussion of which in the Principia he broached the first approximation to the true theory of the cometary tail. These two comets approached so close to the sun that it would seem quite possible that they touched its surface, or, at least, swept in nearer than the solar corona. It would not have been an absurd hypothesis, that they were ejected from the sun at the time of penetration, had it not been for the fact that the comet of 1680 was seen on its way down to the sun, and for the remarkable phenomenon which we are about to describe concerning the comet of 1843. It may be claimed, as a not impossible hypothesis, that each of these comets was at some former time the product of a solar eruption, in accordance with Buffon's theory of the origin of comets. It would only involve a force which would double the greatest velocity given to the solar field of hydrogen. But a juster interpretation of the phenomenon, and one which avoids the necessity of an extravagant volcanic action, is to be found in the relation between the comets and the meteors. It is simply the splash of the falling meteors. In about an hour and a half the comet of 1843, like that of 1680, went round the sun from one side to the other. What would have become of the tail, which was reaching out about 100,000,000 of miles from the sun to the earth's orbit? There have been those who have actually adopted the incredible, I may say the impossible, hypothesis that the tail rotated through this immense circuit, developing a centrifugal force which all the united powers of the universe could not have sustained. No! The comet practically left its tail behind it, and began to grow a new tail as it receded from the sun. There were thus two tails nearly side by side. The new tail was distinguished because it commenced at the head of the comet, whereas the old deserted tail began without any head at some distance from the nucleus, and extended further from the sun than the new tail. That such should be the phenomena of this comet was suggested by a geometer, without knowing that it had been actually observed. It was as veritable and honest a prediction as if it had been made previous to the observation. A double tail was observed on the first four nights after the comet's appearance at noonday. The visible separation of the two tails only lasted for a few days, because the earth passed almost at once into the plane of the comet's orbit, so that one tail eclipsed the other."

Conversion of Cane Sugar into Grape Sugar in Cooking.

At a sanitary convention in Grand Rapids, Michigan, recently, the President of the State Board of Health called attention to a bad practice among cooks, by which cane sugar is converted into grape sugar in cooking, thereby losing more than half of its sweetening power. Some women, he said, will put the sugar in with a mass of acid fruit to be cooked, and keep cooking and keep adding sugar while it keeps on growing sourer, until at last they will use two and a half times as much sugar as they ought to secure the desired result. The cane sugar has been changed to grape sugar. Now, if the sugar had been added after the fruit was cooked, much less would have been required, and the result would have been far more satisfactory.

One Week's Exportation of Live and Fresh Meat.

During the first week of March the steamers sailing from New York to English ports carried 1,221 head of cattle, 650 sheep, and 300 hogs, alive; also 2,408 quarters of beef, 850 carcasses of sheep, and 605 tons of fresh meat, several steamers reporting the dead meat carried only by weight. This is the largest shipment in one week for several months.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.
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Guild's Plastering Machine—The Simplest and Best Tool for applying mortar to walls. One workman using this machine can easily do the work of two men using the ordinary tools. See engraving on page 194. Address Egbert F. Guild, East Saginaw, Mich.

Boat Engines, for sidewheel boats drawing 6 to 12 in; direct acting; link motion; cheap. Box 559, Owego, N.Y.

For Sale.—Two Windmill Patents, and set of patenrs for same. None better. F. C. Maxwell, Columbus, O.

Wanted - The address of Brass Lamp Manufacturers, to fill a large contract. J. J. Hentz, 104 S. Charles St., Baltimore, Md.

Window Safety Guard (for cleaning and repairing windows), simple and effective, by straps, platform. Patent rights and licenses reasonably. R. d'Heureuse, P. O. Box 395, New York.

Best Turkey Emery in kegs, half kegs, and cans; liberal rates by the ton. Greene, Tweed & Co., N. Y.

The newest Plating used for Steel Pens can be seen on Esterbrook's Nickel Plated. Send for samples to Esterbrook Steel Pen Company, 26 John St., New York.

Machines for Tapping Water Mains under Pressure. Apply at Easton Brass Works, Easton, Pa.

For Patent Shapers and Planers, see ills. adv. p. 188.

The genuine Asbestos Roofing is the only reliable substitute for tin, it costs only about one-half as much, is fully as durable, is fireproof, and can be easily applied by any one. H. W. Johns Manufacturing Co., 87 Maiden Lane, N. Y., are the sole manufacturers.

For Separators, Farm & Vertical Engines, see adv. p. 188.

For Sale.—Machine Shop and Foundry, with agl. imp. trade. New buildings; old business; $25,000 invested. Practical partner preferred. P. Camel, care Manufacturers' Exchange, Quincy, Ill.

Blake's Belt Studs. The best and cheapest fastening for rubber and leather belts. Greene, Tweed & Co., N. Y.

For Middlings, Mill and Mill Furnishing, see adv. p. 188.

Wanted – A Situation as Mechanical Draughtsman, by a young Englishman, 20 years of age. Reference and specimens. Address T. Wild, P. O. Box 4090, N. Y. city.

Wanted—A good Manganese Property. Samples and full particulars required. Fuller & Stillman, 40 Broadway, New York.

For Sale.—Four Boilers, 100 horse power each, return drop flue; A 1 condition: $1,500 each. 1 Berryman Heater, 42 x 96; A 1 condition; $400. D. L. Einstein, 16 White St., New York.

Rare Chance to Invest.—Three valuable Patents for sale. Lantern; Self-opening Oyster or Fruit Can; Coal Sifter. E. P. Follett, 41 East Main St., Rochester, N. Y.

Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

Wanted—A Second-hand improved Country Campbell Press, 31 x 46, for $500 cash. A. G. Blair, Waynesboro, Franklin Co., Pa.

A Mechanical Engineer, thorough mechanic and draughtsman, desires engagement. Pumping and hydraulic machinery a specialty. Address Hydraulics, Box 773, New York city.

Peck's Patent Drop Press. See adv., page 173.

All kinds Machine Drawings. Inventors' work a specialty. Office hours 9 to 6. 733 Broadway, 3d floor front.

Vertical & Yacht Engines. T.P. Pemberton, 276 Water St., N. Y.

Having bought the Forsythe Scale Works here, we offer our present manufactory, with 25 H. P. engine and boiler, for sale. This property is well situated for manufacturing, only three blocks from depot. Will be sold low. Waukegan, Ill., is 35 miles north of Chicago. Full description sent on application. Powell & Douglas, M'f'rs Pumps and Windmills, Waukegan, Ill.

Spokes and Rims, white oak and hickory, best quality, to any pattern, and Hammer Handles of best hickory. John Fitz, Martinsburg, West Va.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes. Buffalo, N. Y.

Solid Emery Vulcanite Wheels—The Solid Original Emery Wheel – other kinds imitations and inferior. Caution.—Our name is stamped in full on all our best Standard Belting, Packing, and Hose. Buy that only. The best is the cheapest. New York Belting and Packing Company, 37 and 38 Park Row, N. Y.

Sheet Metal Presses, Ferracute Co., Bridgeton, N. J

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Wright's Patent Steam Engine, with automatic cut-off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Presses, Dies, and Tools for working Sheet Metal, etc. Fruit & other can tools. Bliss & Williams. B'klyn. N. Y.

Bradley's cushioned helve hammers. See illus. ad. p. 174.

Ice Machines selected. Information on all kinds. Benjamin's Sci. Expert Office, 37 Park Row, New York.

Forsaith & Co., Manchester, N. H., & 213 Centre St., N. Y. Bolt Forging Machines, Power Hammers, Comb'd Hand Fire Eng. & Hose Carriages, New & 2d hand Machinery. Send stamp for illus. cat. State just what you want.

Electrical Indicators for giving signal notice of extremes of pressure or temperature. Costs only $20. Attached to any instrument. T. Shaw, 915 Ridge Ave. Phila.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machinery. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

Portable Forges, $12. Roberts, 107 Liberty St., N. Y.

Telephones repaired, parts of same for sale. Send stamp for circulars. P. O. Box 205, Jersey City, N. J.

Eclipse Portable Engine. See illustrated adv., p. 157.

New Inventions examined and tested. Designs and improvements. Reports for investors. Recipes and information on all industrial processes. Benjamin's Sci. Expert Office, 37 Park Row, New York.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

Special Wood-Working Machinery of every variety. Levi Houston, Montgomery, Pa. See ad. page 173.

Improved Solid Emery Wheels and Machinery, Automatic Knife Grinders, Portable Chuck Jaws. *Important*, that users should have prices of these first class goods. Address Amer. Twist Drill Co., Woonsocket, R.I.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Company, Buffalo, N. Y.

Chase's Pipe Cutting & Threading Machine. Send for circular. Chase Machine Co., 120 Front St., New York.

Diamond Tools. J. Dickinson, 64 Nassau St., N. Y.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Wanted—The address of 40,000 Sawyers and Lumbermen for a copy of Emerson's Hand Book of Saws. New edition 1880. Over 100 illustrations and pages of valuable information. Emerson, Smith & Co., Beaver Falls, Pa.

Eagle Anvils, 9 cents per pound. Fully warranted.

Repairs to Corliss Engines a specialty. L. B. Flanders Machine Works, Philadelphia, Pa.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 188.

The "Fitchburg" Automatic Cut-off Horizontal Engines. The "Haskins" Engines and Boilers. Send for pamphlet. Fitchburg Steam Engine Co., Fitchb'g, Mass

For Wood-Working Machinery, see illus. adv. p. 189.

Tight and Slack Barrel machinery a specialty. John Greenwood & Co., Rochester, N. Y. See illus'd adv. p. 62.

Elevators, Freight and Passenger, Shafting, Pulleys, and Hangers. L. S. Graves & Son, Rochester, N. Y.

The Horton Lathe Chucks; prices reduced 25 per cent. Address The E. Horton & Son Co., Windsor Locks, Conn.

$400 Vertical Engine, 30 H. P. See page 188.

Judson's Improved Assay Furnaces and Tongs. Entirely new design. W. E. Judson, Cleveland, O.

Emery Wheels of all kinds, and Machines at reduced prices. Lehigh Valley Emery Wheel Co., Weissport, Pa.

Comb'd Punch & Shears; Universal Lathe Chucks. Lambertville Iron Works, Lambertville, N. J. See ad. p. 108.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 188.

Patent Steam Cranes. See illus. adv., page 189.

Improved Steel Castings; stiff and durable; as soft and easily worked as wrought iron; tensile strength not less than 65,000 lbs. to sq. in. Circulars free. Pittsburg Steel Casting Company, Pittsburg, Pa.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 189.

Drop Hammers, Die Sinking Machines, Punching and Shearing Presses. Pratt & Whitney Co., Hartford, Ct.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

Elevators.—Stokes & Parrish, Phila., Pa. See p. 189.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville N. J.

The Twiss Automatic Cut-off; also Vertical and Yacht Engines. N. W. Twiss, New Haven, Conn.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) E. C. writes: We are using iron turbine water wheels; when there is slush or anchor ice running in the night it sticks to the iron and fills the wheels so as to stop them, while in the daytime, with the same conditions as to degree of cold, wind, and quantity of ice running, it does not bother at all. Can it be explained? A. It is probable that more anchor ice makes during the night than in the day time, the water being in a comparatively quiescent state at night. 2. A board containing 64 square inches surface measure can be cut and put together, so as to measure 65 square inches. Where does the extra inch come from? A. See square puzzle in SUPPLEMENT, No. 21. If you are very careful in your measurements you will find that the board really has the same area in one case as in the other, and that some of the squares along the line of division are enough smaller than the others to account for the existence of the extra square.

(2) C. D. R. writes: I have quite a quantity of grape vines which grow some six feet high. We have in this section early frosts in spring and fall. I wish a light and cheap covering to tack to a wooden frame six by eight feet long. A. We know of nothing better than some of the cheaper grades of cotton cloth.

(3) J. B. asks (1) if one gravity battery cell can be put to any use. A. It will work a sounder or electric bell adapted to light battery power. 2. Can I get an electric shock from it? If so, how? A. Yes, by using an induction coil like that described on page 203, Vol. 39 of SCIENTIFIC AMERICAN. 3. How can I make a voltaic dry pile to be used in an enclosure? A. See SUPPLEMENT, No. 157.

(4) E. M. G. writes: 1. I am running a portable mulay saw mill with a 10 horse power thrashing engine, which is plenty strong, but am troubled some for steam when using green slabs. Now, how would it work to set another portable engine beside the one now in use, and connect the two boilers with a steam pipe, and make steam in both, using one engine? Could they be arranged to burn the sawdust? How large a pipe would be needed to connect the boilers. Would a valve be needed in the pipe to shut off steam from either boiler? A. Yes; set another boiler alongside, and connect with a steam pipe at least as large as that leading to the engine; have no water connection between the boilers, but supply them with water independently. You should have a stop valve in the connecting steam pipe, and be careful to have a separate safety valve on each boiler. With proper arrangements you can burn sawdust with your slabs. 2. Would it be practicable to have an iron tank for hauling water for a thrashing engine, to fill it with steam from the boiler, then start for the water, and when the steam had condensed and formed a vacuum in the tank, to let it suck itself full through a hose, how heavy would the iron need to be to sustain the pressure? A. Yes; you must have tank strong enough to bear safely the greatest internal pressure that the steam will give, and stiff enough to not collapse under the full pressure of the atmosphere.

(5) J. W. S. asks: Can gutta percha be bleached white; if so, what is the process? A. White gutta percha is obtained by precipitating a solution of ordinary gutta percha in chloroform by alcohol, washing the precipitate with alcohol, and finally boiling it in water, and moulding into desired form while still hot.

(6) J. R. asks: What will take old paint off wood without injuring the wood? I am told that I will have to burn it, but I think there is another process. A. Strong aqueous solution of caustic potash softens oil paint, which in this state may be removed by scraping. The potash is, however, liable to injuriously affect the wood. Burning is more commonly resorted to.

(7) W. H. B. writes: Having tried to galvanize some small wrought iron hooks, I could not make the zinc take to the iron. I used a pint of sulphuric acid, pint of muriatic acid, pint of sal ammoniac, and zinc enough to cover the hooks. I first dissolved the zinc with muriatic acid, then I reduced the sulphuric acid with water. I then dissolved the sal ammoniac, then I dipped the hooks into the sulphuric acid, then after washing it off I then dipped it into the muriatic acid; after taking it out and letting it stand for some time, I then dipped it into sal ammoniac, after taking it out and letting it stand some time I then dipped it into the zinc, but on taking it out the zinc would not stick to it. Can you tell me where the trouble is? A. Clean the metal by pickling in the dilute acid, and scouring (or tumbling) with moist sand, if necessary. Rinse quickly in pure water, pass through the chloride of zinc solution, and then transfer to the zinc pot. Keep the melted metal covered with dry sal ammoniac. Moist iron rusts very quickly when exposed to the air, and unless the surface is perfectly freed from this oxide it will not take the zinc.

(8) F. M. O. asks: What is the mode of manufacture, and what are the uses of the so-called mineral wool? What substance can I use to cover the surface of molten metals, say at a dull red heat, to prevent the formation of the film of oxide? Can a glass be made sufficiently fusible to answer the purpose? A. See pp. 20 and 278, Vol. 38, SCIENTIFIC AMERICAN. Have you tried borax (borax glass) or the double borate of sodium and potassium?

(9) E. Y. D. asks: 1. Do you know of anything that will cement two pieces of vulcanite, it being a straight joint? I have tried rubber, and it did not harden in 24 hours. I have also tried good cements which are patented. A. Melt together equal parts of pitch and gutta percha, and add about 1-5th part of shellac. Stir until a perfectly homogeneous mixture is obtained. Use hot (avoiding excess), and submit the joint to strong pressure until the cement has properly hardened 2. Can you tell me what the precipitate of the following is: I took olive oil and made it very hot, almost boiling, into it I dropped a piece of phosphorus; there is now a deposit in the vessel. A. It is probably phosphorus.

(10) F M. asks whether it is preferable to make the upper or the lower belt the driving belt in case of a long horizontal belt. A. All authorities agree, and all experience goes to prove, that a belt should drive by the lower side.

(11) J. S. asks how to compute the horse power of a boiler. A. Total number of square feet of heating surface, divided by 12=H. P.

(12) "Mechanic" asks whether, in order to make a boat buoyant when she is filled with water, it is better to seal up the tanks, simply allowing the atmospheric air to get in; or whether it is better to pump compressed air into the tank. A. Simply seal your tanks. If you fill them with compressed air it will add slightly to the weight the boat must carry.

(13) G. I. B. asks: 1. What is the rule for calculating the horse power a belt will transmit? A. A very safe rule is that at a speed of 800 feet per minute each inch in width of belt equals one horse power, that is, 800 foot inches=1 H. P. 2. Does the same rule apply to friction wheels? A. No. 3. The slides of our engines heat so that they need to be oiled every few minutes, to keep from cutting the crosshead brasses; everything appears to be level and in line; runs about 120 strokes per minute. What is the probable cause? A. They have probably too little bearing surface.

(14) W. E. F. writes: I am a paper manufacturer, and boil my rags and raw stock in "rotary boilers" under, say, 50 lb. pressure, and dry my paper with live steam. We are troubled with too much cinders in the boiler, weakening the chemical solutions, and filling the pipes and drying cylinders in drying machine. I wish to ask: 1. Can we economize heat and fuel by using superheated steam? A. Yes. 2. We have a flue 6x3, 14 feet long, between the brickwork of the boiler and smoke stack. Can we put in this a system of coils, or lengths, of pipe, drying the steam from the heat that would otherwise be wasted? A. Yes, if properly arranged. 3. Would this mode be dangerous? A. If well arranged and managed, no. 4. Will steam so dried do more boiling and drying when superheated than before? A. Yes.

(15) E. H. R. asks: Why would not crude petroleum oil answer as well as creosote oil for the preservation of wood? It is as penetrating, if not more so than any other oil, will not dry, and is cheaper than anything else. A. Petroleum unfortunately renders wood very inflammable. The effects of creosote are more positive and lasting.

(16) L. P. L. asks: 1. How can hair be made to grow on the face most rapidly? Is there anything besides shaving that can be done? A. The growth of hair on the face of adult males is influenced chiefly by constitutional causes. Those causes which tend to produce vigorous health in the general system and in the skin usually stimulate the hair. Chief among these is very frequent bathing. As a rule local applications are useless. 2. How can aniline inks be kept from fading? A. If exposed to light the fading is unavoidable. 3. Can aniline inks be made, by any preparation of the cloth, or addition to the ink, indelible for marking linen? A. With exception of aniline black, no.

(17) C. L. F. asks: 1. Is there any preparation that will cause the beard to grow to extraordinary length or add to its growth in any manner? A. See answer to L. P. L., this page. 2. Is there a preparation which will make a meerschaum pipe of uniform color? I have one that has been in use several years, and is only colored about the lower part of the bowl where the stem goes in. A. Boiling in oil containing annatto is sometimes resorted to.

(18) C. L. B. asks: In changing an engine from 2 feet stroke to 18 inch, would I need to have a shorter cylinder? A. You must either shorten the cylinder or fill up the waste space of the ends by deep heads.

(19) J. C. L. writes: I have heard it said that the majority of persons in looking at objects use one eye only, to a partial exclusion of the other. Is this true? A. It is not generally true. When both eyes are in their normal condition, both are equally used. The full intention of vision is not realized unless both eyes are used. With one eye everything appears flat. With two eyes objects look stereoscopic.

(20) J. W. E. asks whether United States sabers are made of spring or cast steel. A. They are made of the best quality of cast steel.

(21) W. E. B. writes: 1. I have a small steam engine whose cylinder is three inches in length with a two inch bore. How much space should there be between the piston and cylinder head at the end of the stroke? A. Not more than 3-16 inch. 2. Where can I obtain printed instructions by which I can make a model engine? A. We know of none. Follow the proportions of larger engines as given in back numbers of SCIENTIFIC AMERICAN and SUPPLEMENT.

(22) N. T. L. writes: There are two locomotive drive wheels at rest on the track; one is small, the other is large. Does more of the surface of one wheel come in contact with the rail than the other; if so, which one? A. With deflection of the rail, yes. The large one has the most surface in contact. Theoretically if there be no deflection, there would be no difference, as both would rest on a simple line of contact.

(23) C. M. B. asks: Is there any book published on saw hammering. If so, by whom and where can they be obtained? A. You will find a comprehensive article on the subject on p. 259, Vol. 37, SCIENTIFIC AMERICAN.

(24) R. S. asks for the process used in marblizing slate mantels, and how the different shades and colors are acquired. A. The slate is coated with asphalt, ground to a smooth surface, and baked. The paints are mixed in oil and floated on water, the prepared slate being brought into contact with the under surface of the paint by bringing it up through the water. The paint thus adheres in irregular patches, producing the marblization. After drying it is again baked.

(25) F. M. asks (1) if fruit and meat cans are not soldered by machinery. A. Yes. 2. Is mercury used in the solder? A. Mercury has been found in the solder of some cans in which edible substances have been inclosed, but its use in solder cannot be too strongly deprecated, as it not only endangers the lives and health of the persons who consume the canned goods, but it also poisons the workmen who use the solder.

(26) W. D. G. asks: If I build a mill dam, say 17 feet high, and it backs the water up the stream, say 5 miles, how far from the upper side of the dam does the pressure of water operate or press against the dam? A. The pressure against your dam will be the same, whether the water sets back 500 feet or 5 miles; it is the depth of water at the dam which determines the pressure.

(27) L. C. asks: 1. Is the fine edge of a razor produced on a strap by abrading the sides until a sharp angle is produced, or on the particles of steel mag-

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netically arranged by the friction on the strap, or do they both contribute to the result? A. The edge is produced by abrasion. 2. What kind of a fluid dye will color the wings, of a queen bee red or some other bright color (so that she can be readily seen among the bees) without injury to her? It should be something that will not load the wings but leave them light and supple —a dye, not a paint. A. Try an alcoholic solution of the aniline dye magenta.

(28) F. J. will find the wagon wheel question fully discussed on p. 394, Vol. 39 of SCIENTIFIC AMERICAN.

COMMUNICATIONS RECEIVED.

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[OFFICIAL.]

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A complete copy of any patent in the annexed list, including both the specifications and drawings, or any patent issued since 1867, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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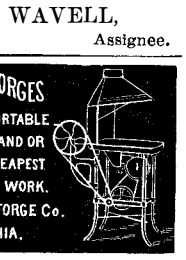

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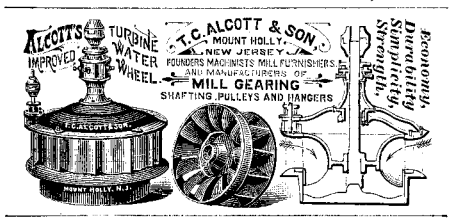
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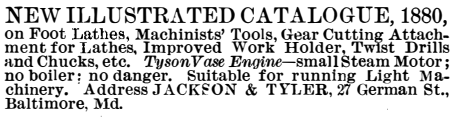

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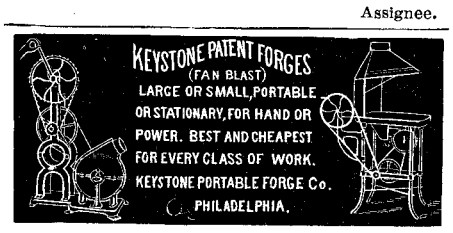
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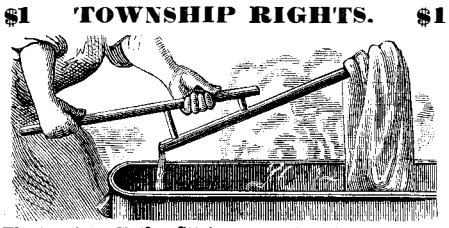

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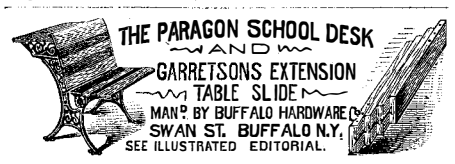

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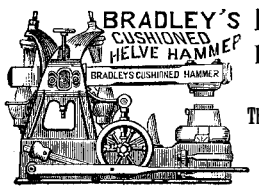

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The many readers of this Paper will no doubt remember, during the past six months, having seen our advertisement of the now celebrated **CHICHESTER RIFLE,** accompanied by flattering editorial notices in the New York "Tribune," "Atlas," "World," and other leading newspapers throughout the country. In response to a universal demand from aliquarters, we decided to materially improve our rifle, and as now offered it is the most complete weapon of the kind in existence. The simple addition of PEEP and GLOBE SIGHTS (for which other manufacturers charge from $3 to $5) is worthy of special attention. Notwithstanding the immense advance in both metal and labor we shall offer the **CHICHESTER** with all the new improvements at the same proportionate BED ROCK price as before. WE DEFY COMPETITION from any of the monopolist high price manufacturers, and as the "New York Tribune" and other papers justly remarked, offer the *best* bargain in Fire-arms ever presented to the American people. These Rifles have been in course of active manufacture for over one year. The Patents which cover them being dated March 28th, 1871, May 27th, 1879. **CHICHESTER RIFLES** are WARRANTED and GUARANTEED *to be made of as fine material and in as thorough a manner in every respect as any fire-arm in the World.* Every part is made by special and expensive machinery, and in very large lots. Fire-arms, like Sewing Machines and Pianos, have always paid an *enormous profit* to the manufacturers; the actual cost being but a small part of the selling price. The **CHICHESTER** will never be sold at the immense profit asked by the manufacturers of other fire-arms, but only for the purpose of introduction will it be sold at the present price, and only for a limited time. We know this to be in the end the most effective and cheapest way to introduce any meritorious article. We GUARANTEE the **CHICHESTER** to be equal in MATERIAL and WORKMANSHIP to any Rifle in the World. *The best material only is used.* The barrels are 22 inches long, made of steel, and rifled in the most careful manner. The trimmings are all nickel-plated. Black Walnut Stock and very handsomely designed hard-rubber pistol grip. Adjustable PEEP and GLOBE Sights, case-hardened hammer and trigger, and *the best of steel locks.* **BEAR IN MIND** this is no old-fashioned paper cartridge army gun, big bored and clumsy, nor small revolver with cheap wood stock. It is a BRAN NEW **REPEATER,** using regular Metallic Cartridges of 22, 32 and 38 calibre, which are sold everywhere. **FIRES SEVEN TIMES** with one loading, and is very ACCURATE and EFFECTIVE at both *short* and *long* distances. It can be loaded in fifteen seconds, and every shot discharged in ten seconds if necessary. Can be used as a single shot rifle if desired. Every one is shot and thoroughly tested before leaving the factory. *Every one is numbered* and a **WARRANT** *is given for each, signed by the Company.* We have targets made with the **CHICHESTER** at mid range, that cannot be beaten. Each one is packed separately in a neat case, with cleaning rod, &c., and sent to any address on receipt of price. We will get *special rates* from the Express Companies and can guarantee that the Express Charges will not amount to over 50 or 75 cents to most parts of the country. We cannot of course send by mail.

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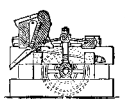
For our responsibility we refer to the principal Banks and Express Companies of Jersey City. In ordering send Money by Registered Letter, Post Office Money Order, Draft on New York, or, if preferred, forward to any Express Agent in Jersey City, with instructions to *pay* money to us on *delivery* of the Rifle. Make all Checks and Money Orders payable to **CHICHESTER RIFLE CO.** W. N. FITCHETT, Treasurer, **31 Montgomery Street,** Jersey City, New Jersey, U. S. A.
Incorporated under Laws of the State of New Jersey

BLAKE'S CHALLENCE ROCK BREAKER.
Patented November 18, 1879.



For *Macadam Road* making, Ballasting of *Railroads,* Crushing *Ores,* use of *Iron Furnaces,* etc, Rapidly superseding our *older styles* of Blake Crusher on account of its superior *strength, efficiency,* and *simplicity.* Adopted by important Railway and Mining Corporations, Cities, and Towns First Class Medal of *Superiority* awarded by American Institute.
BLAKE CRUSHER CO., Sole Makers, New Haven, Conn.

THIRTY-FIFTH ANNUAL REPORT
OF THE
NEW YORK LIFE INSURANCE CO
OFFICE, Nos. 346 and 348 BROADWAY.
JANUARY 1, 1880.

Amount of Net Cash Assets, January 1, 1879.....$36,213,457.61
Less deduction to cover decrease in value of U. S. Bonds and other assets..... $135,966.93
$36,077,490.68

REVENUE ACCOUNT.

Premiums	$6,382,875.25	
Less deferred premiums Jan. 1, 1879	379,839.09	$6,003,036.16
Interest and rents	2,339,875.93	
Less interest accrued Jan. 1, 1879	306,225,93	$2,033,650.00—$8,036,686.16
		$44,114,176.84

DISBURSEMENT ACCOUNT.

Losses by death, including Reversionary additions to same		$1,569,854.22
Endowments matured and discounted, including Reversionary additions to same		1,015,256.22
Annuities, dividends and returned premiums on cancelled policies		2,236,379.97
Taxes and re-insurances		173,608.64
Commissions, brokerages, agency expenses and physicians' fees		626,253.30
Office and law expenses, salaries, advertising, printing, &c		307,392.81—$5,928,745.16
		$38,185,431.68

ASSETS.

Cash in bank, on hand, and in transit (since received)		$1,961,701.48
Invested in United States, New York City, and other stocks (market value $14,356,192.94)		13,544,671.96
Real estate		4.974,573.68
Bonds and mortgages, first lien on real estate (buildings thereon insured for $14,287,000.00 and the policies assigned to the company as additional collateral security)		15,313,278,95
Temporary loans, (secured by stocks, market value $1,300,000)		850,000.00
* Loans on existing policies, (the reserve held by the company on these policies amounts to $3,160,000)		621,403.02
* Quarterly and semi-annual premiums on existing policies, due subsequent to Jan. 1, 1880		367,989.02
* Premiums on existing policies in course of transmission and collection (estimated reserve on these policies, $330,000. included in liabilities)		211,625.23
Agents' balances		22,199.23
Accrued interest on investments Jan. 1, 1880		317,989.11—$38,185,431.68

**A detailed schedule of these items will accompany the usual annual report filed with the Insurance Department of the State of New York.*

Excess of market value of securities over cost 811,520.98

CASH ASSETS, Jan. 1, 1880.....$38,996,952.66

Appropriated as follows:

Adjusted losses, due subsequent to Jan 1, 1880	$225,662.64
Reported losses, awaiting proof, &c	213,271,31
Matured endowments, due and unpaid	32,780.98
Reserved for re-insurance on existing policies; participating insurance at 4 per cent. Carlisle net premium; non-participating at 5 per cent. Carlisle net premium	34,016,840.82
Reserved for contingent liabilities to Tontine Dividend Fund, over and above a 4 per cent. reserve on existing policies of that class	1,371,482.18
Reserved for premiums paid in advance	16,543.25—$35,876,581.18
Divisible surplus at 4 per cent	3,120,371.48
	$38,996,952.66

Surplus, estimated by the New York State Standard at 4 1-2 per ct., over $7,000,000.00

From the undivided surplus of 3,120,371.48 the Board of Trustees has declared a Reversionary dividend to participating policies in proportion to their contribution to surplus, available on settlement of next annual premium.

During the year 5,524 policies have been issued, insuring 17,098,173.

Number of Policies in force	Jan. 1, 1876, 44,661.	Amount at risk	1876, $126,132,119.	Death-claims paid	1875, $1,524,815.
	Jan. 1, 1877, 45,421.		1877, 127,748,473.		1876, 1,547,648.
	Jan. 1, 1878, 45,605.		1878, 127,901,887.		1877, 1,638,128.
	Jan. 1, 1879, 45,005.		1879, 125,232,144.		1878, 1,687,676.
	Jan. 1, 1880, 45,705.		1880, 127,417,763.		1879, 1,569,854.

Income from Interest	1875, $1,870,658.	Divisible surplus at 4 per cent.	Jan. 1, 1876, $2,499,654.
	1876, 1,906,750.		Jan. 1, 1877, 2,626,816.
	1877, 1,867,457.		Jan. 1, 1878, 2,664,144.
	1878, 1,948,665.		Jan. 1, 1879, 2,811,436.
	1879, 2,033,650.		Jan. 1, 1880, 3,120,371.

TRUSTEES.

MORRIS FRANKLIN, WM. H. APPLETON, WILLIAM BARTON, WILLIAM A BOOTH, H. B. CLAFLIN, JOHN M. FURMAN, DAVID DOWS, GEORGE A. OSGOOD, HENRY BOWERS, LOOM L. WHITE, ROBERT B. COLLINS, S. S. FISHER, WILLIAM H. BEERS, CHAS. WRIGHT, M. D., EDWARD MARTIN, JOHN MAIRS, EDW. A. WHITTEMORE, HENRY TUCK, M. D., ALEXANDER STUDWELL,

THEODORE M. BANTA, Cashier.
D. O'DELL, Superintendent of Agencies.
CHARLES WRIGHT, M. D. } Medical Examiners.
HENRY TUCK, M. D. }

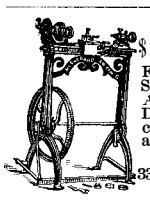
MORRIS FRANKLIN, *President.*
WILLIAM H. BEERS, *Vice-Pres't & Actuary.*

The Premium Bucket.

DUC'S IMPROVED ELEVATOR BUCKET.
Made in sizes from 3½ to 20 inches. For use in FLOUR, GRAIN, MALT, ORES, COAL, BROKEN STONE, SAND, DRUGS, SPICES, PLASTER, etc., etc. These buckets are struck out from the *best charcoal iron,* and are almost indestructible. No corners to catch. No seams to burst. Run with great ease and fill *full* every time. No interior corners to clog up.
T. F. ROWLAND, Sole Manufacturer, Brooklyn, N. Y.

COE BRASS MFG. CO.
BRASS AND COPPER IN SHEETS. WOLCOTTVILLE CONN. MATERIALS FOR METALLIC AMMUNITION A SPECIALTY. WIRE AND BLANKS

MACHINISTS' TOOLS.
NEW AND IMPROVED PATTERNS.
Send for new illustrated catalogue.
Lathes, Planers, Drills, &c.
NEW HAVEN MANUFACTURING CO.,
New Haven, Conn.



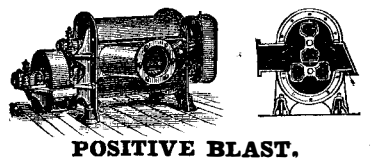
SHEPARD'S CELEBRATED
$50 Screw Cutting Foot Lathe.
Foot and Power Lathes, Drill Presses, Scrolls, Circular and Band Saws, Saw Attachments, Chucks, Mandrels, Twist Drills, Dogs, Calipers, etc. Send for catalogue of outfits for amateurs or artisans.
H. L. SHEPARD & CO.,
331, 333, 335, & 337 West Front Street,
Cincinnati, Ohio.

Wood-Working Machinery,
Such as Woodworth Planing, Tonguing, and Grooving Machines, Daniel's Planers, Richardson's Patent Improved Tenon Machines, Mortising, Moulding, and Re-Saw Machines. Eastman's Pat. Miter Machines, and Wood-Working Machinery generally. Manufactured by
WITHERBY, RUGG & RICHARDSON.
26 Salisbury Street. Worcester, Mass.
(Shop formerly occupied by R. BALL & CO.)

FIRE BRICK. TILE AND CLAY RETORTS ALL SHAPES.
BORGNER & O'BRIEN.
23 RD ST. ABOVE RACE, PHILADELPHIA.

Pond's Tools,
Engine Lathes, Planers, Drills, &c.
DAVID W. POND, Worcester, Mass.

ROOTS' NEW IRON BLOWER.

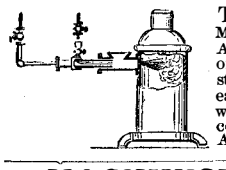


POSITIVE BLAST.
IRON REVOLVERS, PERFECTLY BALANCED
IS SIMPLER, AND HAS
FEWER PARTS THAN ANY OTHER BLOWER.
P. H. & F. M. ROOTS, Manuf'rs,
CONNERSVILLE, IND.
S. S. TOWNSEND, Gen. Agt., { 6 Cortlandt St., 8 Dey Street,
WM. COOKE, Selling Agt., 6 Cortlandt Street,
JAS. BEGGS & CO., Selling Agts., 8 Dey Street, } NEW YORK.
SEND FOR PRICED CATALOGUE.

THE HOLLY SYSTEM OF STEAM HEATING COMBINATION CO. LIMITED.
FOR CITIES AND VILLAGES. HOLLY STEAM COMBINATION CO. LOCKPORT N.Y.
SEE ILLUSTRATED AD IN LAST NUMBER.

THE DRIVEN WELL.
Town and County privileges for making **Driven Wells** and selling Licenses under the established **American Driven Well Patent,** leased by the year to responsible parties, by
WM. D. ANDREWS & BRO.,
235 BROADWAY, NEW YORK.

The George Place Machinery Agency
Machinery of Every Description.
121 Chambers and 103 Reade Streets, New York.



THE FORSTER-FIRMIN GOLD AND SILVER AMALGAMATING COMP'Y of Norristown, Pa., will grant state rights or licenses on easy terms. This system works up to assay, and recovers the mercury rapidly. Apply as above.

MACHINISTS' TOOLS.
Iron Planing Machines
A SPECIALTY.
C. WHITCOMB & CO., Worcester, Mass.

DO YOUR OWN PRINTING.
$4 Self-Inking Printing Press, with complete outfit, **$5.50.** $ larger sizes. Catalogue and reduced price list free.
H. HOOVER, Philadelphia, Pa.

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Advertisements.

Inside Page, each insertion - - - 75 cents a line.
Back Page, each insertion - - - $1.00 a line.
(About eight words to a line.)

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.

COLUMBIA BICYCLE.

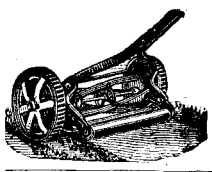
A practical road machine. Indorsed by the medical profession as the most healthful of outdoor sports. Send 3 cent stamp for 24 page catalogue, with price list and full information, or 10 cents for catalogue and copy of *The Bicycling World*.

THE POPE M'F'G CO.,
89 Summer Street,
Boston, Mass.

The Asbestos Packing Co.,

Miners and Manufacturers of Asbestos,
BOSTON, MASS.,
OFFER FOR SALE:

PATENTED ASBESTOS ROPE PACKING,
" " LOOSE "
" " JOURNAL "
" " WICK "
" " MILL BOARD,
" " SHEATHING PAPER,
" " FLOORING FELT.
" " CLOTH.



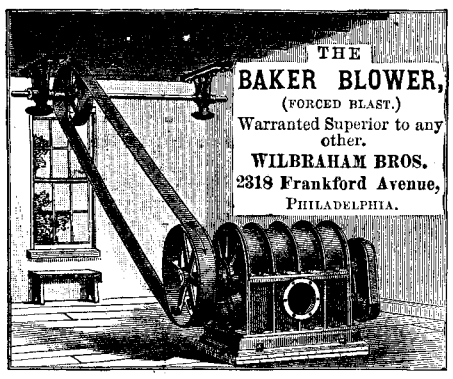
"BUCKEYE" LAWN MOWER.

The lightest and easiest running MOWER ever made.
STRICTLY FIRST CLASS.
MAST, FOOS & CO., Springfield, Ohio.
Send for catalogue.

H.W.JOHNS' ASBESTOS ROOFING.

The Asbestos Roofing (with white or light gray Fireproof coating) is now in use in all parts of the world, and is the only reliable substitute for tin. It is adapted for steep or flat roofs in all climates. It costs only half as much as tin, and can be easily applied by any one.
☞ Note the address, send for samples, and be sure and get the *genuine*, which is manufactured only by

H. W. JOHNS M'F'G CO.,
87 Maiden Lane, New York,
sole manufacturers of genuine Asbestos Liquid Paints, Boiler Coverings, etc.
Descriptive Price Lists free by mail.



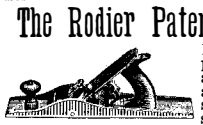
Lathes, Planers, Shapers

Drills, Bolt and Gear Cutters, Milling Machines. Special Machinery. E. GOULD & EBERHARDT, Newark, N. J.

PORTLAND CEMENT,

From the best London Manufacturers.
K. B. & S. AND BURHAM CEMENTS.
For sale by JAMES BRAND, 85 Beekman St., New York.

The Rodier Patent Single Iron Plane.



Made of extra quality iron. A practical labor saving tool. Cuts against the grain equally as well as with it. Can be adjusted instantly to cut a coarse or fine shaving, and excels any double iron plane ever produced. Address LAFLIN MANUFACTURING CO., North Elm Street, Westfield, Mass.

1780 Centennial Industrial Exposition. 1880

NASHVILLE, TENNESSEE, Feb. 24, 1880.

We announce to the Exhibitors and Visitors of the United States, that extensive and elaborate preparations are being made to celebrate NASHVILLE'S CENTENNIAL year with becoming ceremonies, civic and military, and the progress of a hundred years will be best illustrated by celebrating it with an exposition of all that tends to the happiness, prosperity, and welfare of our common country.

We therefore call the attention of Manufacturers, Artists, Scientists, Educators, and the progressive men of the country to this feature of the celebration, which will be opened to the public on Friday, April 23, 1880, at 7 o'clock P. M., and continue day and night, Sundays excepted, until the 29th day of May.

Applications for space will be received and registered from this date.

Articles received for exhibition until Thursday, April 22, 1880.

The buildings are new, commodius, and built expressly for this occasion.

The main line of shafting is 3 3-16 inches diameter, and will run 300 revolutions to the minute.

The Agricultural line of shafting, 2⅞ inches diameter, will be same speed as main line.

Ample power—no premiums offered—believing that proper advertising is worth more than premiums.

Favorable rates on articles for exhibition over all lines of railroads, and excursion rates for visitors and tourists.

Correspondence solicited from all parts of the Union.
Address DR. GEO. S. BLACKIE.
Nashville, Tenn.

The J. L. Mott Iron Works,

88 and 90 BEEKMAN ST.,
Manufacturers of
DEMAREST'S PATENT
WATER CLOSETS.
Simple in construction, perfect in operation, thoroughly excluding all sewer gas, and cleanly in every way.

THE EARLE STEAM PUMP.

Greatly Improved. Reduced in Price. Manufactured in Immense Variety.
THE NORWALK IRON WORKS CO., South Norwalk, Conn.

THE WATSON PUMP, FOR ARTESIAN, OR DEEPWELL ROD IN DIRECT LINE MACHINE SIMPLE, EFFICIENT. PUMPING PISTON ROD, PLUNGER & WELL JAMES WATSON 1608 S. FRONT ST. PHILA.

Gear Molding without Patterns

Scott's Gear Moulding Machines,

AIR COMPRESSORS & ROCK DRILLS.

DELAMATER IRON WORKS,
Boiler Makers, Engine Builders, and Founders,
FOOT OF W. 13th ST., North River, NEW YORK.
ESTABLISHED 1841.

WOOD SOLE SHOES. The cheapest, most durable, warm, good looking, and thoroughly waterproof shoe. Particularly adapted to Brewers, Miners, and all classes of laborers. Send stamp for circular and price list.
CHAS. W. COPELAND,
122 Summer St., Boston, Mass.

BOYLE ICE MACHINE CO.,

10 N. Jefferson St., Chicago, Ill.
The best Ice and Refrigerating Machines of all sizes and for all purposes guaranteed. Send for circular.

TELEPHONE Works 1 mile. Price $3.50. Pat'd
Circulars free. HOLCOMB & Co., Mallet Creek, Ohio.

THE PICTET ARTIFICIAL ICE COMPANY, Limited,
Ice Machines to make from 20 pounds per hour to 50 tons per day, at 36 Cortlandt St., New York. P. O. Box 3083.

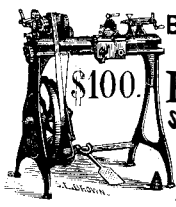
THE SKINNER PORTABLE & STATIONARY ENGINES BOILERS & GOVERNORS
FIRST CLASS & ECONOMICAL SKINNER & WOOD, ERIE, PA.
SEE ILLUSTRATED ADVERTISEMENT

The New York Ice Machine Company,

21 COURTLANDT STREET. ROOM 54.
Low Pressure Binary Absorption System.
Advantages over other Machines.
Makes 25 per cent. more Ice. Uses only ¼ water of condensation. No Pressure at rest. Pressure in running, 14 pounds. Self-lubricating. No Leaks, non-inflammable. No action on Metals. Easy Attendance.

"The 1876 Injector."

Simple, Durable, and Reliable. Requires no special valves. Send for illustrated circular.
WM. SELLERS & CO., Phila.



BEST AND CHEAPEST FOOT POWER SCREW CUTTING ENGINE LATHES
SEE FULL DESCRIPTION IN SCIENTIFIC AMERICAN, JULY 27
SEND FOR ILLUSTRATED CATALOGUE
GOODNOW & WIGHTMAN
176 WASHINGTON ST BOSTON MASS.

Holly's Improved Water Works.

Direct Pumping Plan. Combines, with other advantages, over older systems, the following: 1. Secures by variable pressure a more reliable water supply for all purposes. 2. Less cost for construction. 3. Less cost for maintenance. 4. Less cost for daily supply by the use of Holly's Improved Pumping Machinery. 5. Affords the best fire protection in the world. 6. Largely reduces insurance risks and premiums. 7. Dispenses with fire engines, in whole or in part. 8. Reduces fire department expenses. For information by descriptive pamphlet, or otherwise, address the
HOLLY MANUFACTURING CO., Lockport, N. Y.

CENTENNIAL AND PARIS MEDALS.
Mason's Friction Clutches and Elevators.
"New and Improved Patterns."
VOLNEY W. MASON & CO., Providence, R. I., U. S. A.

Do Your Own Printing.

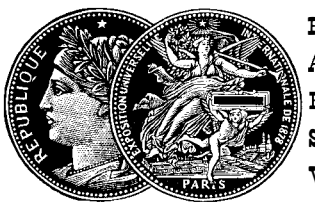
$3 Press for cards, envelopes, etc. 14 other sizes, $8, $14, $25, $44, etc. Type setting easy by printed instructions. Do your own printing and advertising. Money made fast in any place jobbing or running a paper. Catalogue of Presses, Type, Cards, etc., for 2 stamps. **Kelsey & Co., Man'f'rs, Meriden, Conn.**

FRIEDMANN'S PATENT INJECTOR,
The best
BOILER FEEDER
In the world.
Simple, Reliable, and Effective.
40,000 IN ACTUAL USE.
NATHAN & DREYFUS,
Sole Manufacturers, ***NEW YORK.***
Send for Descriptive Catalogue.

BRASS AND COPPER TUBES, SEAMLESS & BRAZED
MERCHANT & CO. PHILADA.

OPERA and FIELD GLASSES of the greatest power combined with portability and low prices. Send for illustrated catalogue to
R. & J. BECK,
Manufacturing Opticians, Philadelphia, Pa.

BOGARDUS' PATENT UNIVERSAL ECCENTRIC MILLS—For grinding Bones, Ores, Sand, Old Crucibles, Fire Clay, Guanos, Oil Cake, Feed, Corn, Corn and Cob, Tobacco, Snuff, Sugar, Salts, Roots, Spices, Coffee, Cocoanut, Flaxseed, Asbestos, Mica, etc., and whatever cannot be ground by other mills. Also for Paints, Printers' Inks, Paste Blacking, etc. JOHN W. THOMSON, successor to JAMES BOGARDUS, corner of White and Elm Sts., New York.



Paris, . . 1878
Australia, 1877
Phila., . . 1876
Santiago, 1875
Vienna, . 1873

J. A. FAY & CO'S WOOD WORKING MACHINERY

was awarded at the Paris Exposition over all competitors **THE GOLD MEDAL OF HONOR.** Also highest award at Phila., Santiago, Australia, and Vienna. It is
Original in Design, Simple in Construction, Perfect in Workmanship, Saves labor, Economizes lumber, and Increases products of the highest standard of Excellence.
Railroad, Furniture, and Agricultural Implement Shops, Planing Mills, etc., equipped at short notice, and the lowest cash prices. Send for Circulars.
J. A. FAY & CO., Cincinnati, Ohio, U. S. A.

HARTFORD STEAM BOILER Inspection & Insurance COMPANY.

W. B. FRANKLIN, V. Pres't. J. M. ALLEN, Pres't.
J. B. PIERCE, Sec'y.

DOUBLE PITMAN PRESSES.
STILES & PARKER PRESS CO., Middletown, Ct.

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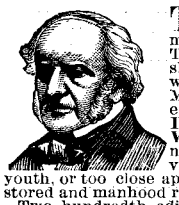

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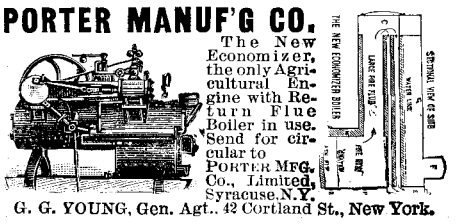

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